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Arlene R. Zide (Ed.) et al.

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THE SOVIET DECIPHERMENT OF THE INDUS VALLEY SCRIPT

Translation and critique

edited by

ARLENE R. K. ZIDE and KAMIL V. ZVELEBIL

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PREFACE

Though the attempted decipherment of the Proto-Indian texts by the Soviet team must on the whole be considered unsuccessful, the following monographs are perhaps the best treatment to date of various aspects of the problem of decipherment of the Proto-Indian script of the Indus Valley. The Soviet team, made up of linguists of varying abilities, ethnologists and mathematicians, carried out various computer-oriented analyses on the thousands of brief inscriptions incised on seals, sherds, amulets and copper plates from the Indus Valley civilization (now dated from approximately 2200 B. C. to 1750 B. C. at its outer limits). Basing their analyses on the assumption that the inscriptions are monolingual, and limited in extent and content, they employed positional and interval statistics using controls consisting of equivalent comparisons of known writing systems.

The conclusions reached regarding the typological character of the language of the inscriptions seem to be sound; however, the manner in which concrete readings were supplied for Dravidian were not based on precise or extensive enough procedures and so must be discounted. Various equations are made but since they are not based on rigorous assessment of the inner workings of the script, nor on material tested by means of grids or an *index a tergo* one finds that no concrete internal system emerges; in fact, no system emerges which one can agree shows a Dravidian solution to be incontrovertible.

Their conclusions then, are significant, since they are generally based on sound computer and statistical procedures, and acceptable from the point of view of Dravidian linguistics, but cannot be proved or disproved. However, the Soviet (and S.I.A.S.[1]) monographs independently arrive at the same conclusions regarding the typology of the language of the Proto-Indian inscriptions — that the typological characteristics of the Proto-Indian script include suffixation (rather than prefixation and infixation); modifiers precede the modified

[1] A. Parpola *et al.*, *Decipherment of The Proto-Dravidian Inscriptions of the Indus Civilization* (Copenhagen, 1969). (Scandinavian Institute of Asian Studies.)

element; there is stable word-order; and nouns occur before other nouns as their modifiers. The choice of possible underlying language is, therefore, narrowed down considerably; the most likely choices are Dravidian or Altaic.[2] The possibility exists then, as in the case of Linear B, that given a narrow range of likely languages, one could demonstrate an internally consistent system which would give satisfaction both in terms of the internal structure of the script (based on what is known about writing systems in general), and further confirmation in the form of a consistent system of language underlying the script which would agree with a reconstruction of one of the alternatives — for instance, Proto-North Dravidian — which may itself be reconstructed by independent historical and comparative linguistic methods. This would constitute the limits to which a decipherment could be proved or disproved using data of such a limited and restricted nature as those provided in the corpus of inscriptions of the Indus Valley — or Proto-Indian — script.

The translation of the first monograph and the reproduction *in toto* (without any additions, corrections or editing) of the second monograph contain critical commentary following each of the individual papers. As will be evident, the quality of the individual papers varies considerably. Needless to say, the translation has had as its object only a faithfulness to the original and makes no claim to literary elegance. The unevenness of the monographs, the frequent overassertiveness and lack of rigor and documentation constitute some of the major flaws in the monographs but do not eliminate their significance as the first attempt to employ computer techniques and statistical methods (however limited) to the Proto-Indian inscriptions.

Within the Russian texts, footnotes and comments, as well as information supplied, are enclosed in brackets.

A. Z. and K. Z.

Chicago, 1968

[2] Or a member of some now extinct language family; this would make decipherment impossible without a bilinguis with another known language.

ACKNOWLEDGEMENTS

The editors wish to express their gratitude to the many people who in one way or another contributed to the completion of this monograph. In particular, we would like to thank Norman H. Zide for his patience in reading the various drafts and for his many useful and insightful comments. Invaluable comments on various aspects of the Soviet monographs were given by I. J. Gelb of the Oriental Institute.

We would also like to express our thanks to Henry I. Saxe, J. A. B. van Buitenen, Martin B. Powell, Howard I. Aronson, Edward Stankiewicz, A. K. Ramanujan, Brenda Beck, Colin P. Masica and George R. Hughes. Finally, we are grateful to Shirley Payne and Dorian Linton for their help in typing the manuscript in its various stages.

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PART ONE

PRELIMINARY REPORT ON THE INVESTIGATION OF THE PROTO-INDIAN TEXTS

MOSCOW, 1965

Academy of Sciences USSR
Soviet Institute of Scientific and Technical Information
Institute of Ethnography

FOREWORD

This short collection of papers is the second in a series of publications of the Institute of Scientific and Technological Information and the Institute of Ethnography of the Academy of Sciences of the Union of Soviet Socialist Republics[1] dedicated to the decipherment of ancient texts.

One of the most important tasks before the IEAS of the USSR is to set up systems of information and to build up a national information service. In this light, the investigation of sign-systems and the setting up of an optimum sign-system based on this investigation—a system which it will be possible to use for practical purposes—is a most important task.

Within the general area of the study of sign-systems, the investigation of ancient writing systems is one of the most urgent tasks. It is necessary to point out that the methods of the investigation of the texts with the aid of statistical techniques described in the present short volume which have been employed in the ISTI can be used not only for the decipherment of old systems of writing, but also for the investigation of sign-systems which differ from each other entirely. This fact illustrates the importance of the method of investigation of ancient texts for the whole sphere of scientific information—a method which is described in the present volume.

Professor A. I. Mikhailov

Director of the Institute

[1] [Editors' note: hence abbreviated in the text as ISTI and IEAS of the USSR respectively.]

INTRODUCTION

In the middle of 1964, scholars from the IEAS of the USSR, together with a team of philologists led by Dr. Yu. V. Knorozov, set before themselves the task of investigating the Proto-Indian texts with the aid of computer techniques. The work proceeded under the general guidance of the Scientific Council of Cybernetics at the Presidium of the Academy of Sciences. The investigations were performed in the Section of Semiotics of the Scientific Council of the Committees for the Decipherment of Historical Systems of Script.

In the 1920's, archeologists discovered in the Indus Valley, in the valley of the River Saraswati and on the Kathiawar Peninsula, as well as in Mesopotamia, the remnants of an ancient Indian culture which flourished in the third millenium B. C., and which was contemporaneous with the cultures of Egypt, Sumer, and China. Of exceptional importance to the determination of the ancient history and ethnic identity of the builders of Proto-Indian civilization are the preserved texts composed in an unknown language.

Up to the present time, all attempts at decipherment have been futile. This is so primarily because the inscriptions, which were preserved mostly on seals, were very short and specific in content.

Many words are met with only once and therefore their meaning cannot be inferred from the context. It is quite obvious that any breakthrough in the sphere of the decipherment of the Proto-Indian Script is of enormous importance, because it may help to solve many problems of the most ancient history of the nations of India and of the Ancient [Near] East.

The members of the ISTI of the Academy of Sciences of the USSR and the members of the Philological Team of the Committee for Decipherment worked out programs for the investigation of Proto-Indian texts, and were successful in ascribing general characteristics to the language of the Proto-Indian texts and connecting it with known and studied groups of languages. The results of the investigation have shown that the language of the Proto-Indian texts is, in [its] basic characteristics, akin to the Dravidian languages. It is imperative the investigation of the texts continues with the aid of computer techniques.

Professor D. A. Olderogge
Corresponding Member Academy of Sciences of the USSR

ABBREVIATIONS

Ch	E. J. Mackay, *Chanhu-Daro. Excavations 1935–36* (New Haven, 1943).
H.	M. S. Vats, *Excavations at Harappa* (Delhi, 1940).
MI	J. Marshall, *Mohenjo-Daro and Indus Civilization*, vols I, II, III (London, 1931).
MII	E. J. Mackay, *Further Excavations at Mohenjo-Daro* (Delhi, 1938).
DED	T. Burrow and M. B. Emeneau, *Dravidian Etymological Dictionary* (Oxford, 1961).
Skt	Sanskrit.
Tam	Tamil.

THE CHARACTERISTICS OF THE PROTO-INDIAN SCRIPT

G. V. ALEKSEEV

1. The Proto-Indian script consists of approximately 450 graphemes. A significant number of the graphemes are arranged vertically and symmetrically relative to the vertical axis. In a number of graphemes the enclosed contours are sometimes crossed out with thin lines. In the inscriptions with large and clearly executed signs, there is a decorative element: the edges of the sign are kept separate; the angles are sharpened; supplementary elements are added.

2. The characters which are used in the Proto-Indian inscriptions can be divided into two groups: ordinary and cursive. The majority of the seals bear inscriptions in the ordinary script. The writing is quite clear without placing individual small details in relief and without a great quantity of decorative elements. Sometimes we come across inscriptions finely executed to the smallest detail, with decorative additions: MI no. 337, MII nos. 422, 616. The cursive [variety] is rather unclear writing in some cases, with considerable distortions of the signs, and without any decorative additions, e.g., MII nos. 327, 434, 482.

3. In the Proto-Indian script we encounter rather a large quantity of allographs. The allographs were discovered mainly through comparison of signs which were similar in shape and through the realization that the signs being compared entered into stable combinations.

4. Variations constitute a considerable part of the allographs, i.e., the contours are somewhat changed without adding any new elements. For example, sign 87 on seals MI nos. 1, 21, 93, 385, 405. A number of allographs come about at the cost of simplification of the manner in which the sign is written and at the cost of the removal of the decorative elements, e.g., sign 22 on the seals MI nos. 121, 424; sign 76 on the seals MI nos. 8, 26, 56, 105. Several allographs are formed by the introduction of supplementary elements and decorative lines with closed contours; e.g., sign 37 on seals MI nos. 140, 438; sign 220 on seals MI nos. 11, 80. The total number of allographs is not less than 100, and hence, the number of signs in the Proto-Indian script is ca. 350.

5. In the existing catalogs of the signs of the Proto-Indian script, a great

number of allographs are included as independent signs which, to a great extent, complicates the use of these catalogs. Apart from the allographs, there are a number of other drawbacks to the catalogs. Some of the signs which occur on the seals are not included in Langdon's catalog,[1] and the diagrams [sic] are sometimes given as one sign, e.g., signs nos. 234, 240.

In Hunter's catalog,[2] the signs are collected in groups which include a great number of allographs and variations. In a few cases, completely different signs are given as allographs. Further, as was the case with Langdon's catalog, some signs occurring on the seals are missing. Those signs which are missing in the catalogs were numbered with new numbers beginning with no. 400.

6. The sequence in which the signs were written, obviously, must correspond to the sequence in which the signs were read. Thus, [it follows that] the problem of the sequence of the reading of the signs is equivalent to the problem of the sequence in which the signs are written in a line.

In the majority of cases the inscription on the seals and other objects is composed of a single horizontal line. On seals with the image of a creature the line is situated above. Inscriptions also occur which are composed of two lines, (MI nos. 1, 12, 16, 52, 99, 101, 135, 139, 209, 237, 247, 253, 278, 302, 321, 329, 340, 341, 355, 389, 396, 550; MII nos. 24, 83, 119, 228, 235, 264, 279, 312, 332, 336, 373, 398, 405, 430, 431, 456, 466, 471, 518, 519, 521, 543, 564, 577, 587, 598, 601, 611, 644, 667, 687, 689, 696; metal plate, table XCIII, 4; nos. 12, 13, 16, 20; of three lines MI nos. 93, 400).

7. On many seals which have a sufficiently long line, one can observe the tendency towards a certain compression of the signs which are written on the right side from the head of the creature represented on the seal to its tail. (One must bear in mind that in different publications the photographs of the sealings have been reproduced and not the seals themselves.) The signs occurring on the left are written normally, [i.e.,] without any signs of compression. For example, MI no. 100 (the righthand sign is compressed), no. 233 (two signs on the right side are compressed), no. 343 (the sign occurring on the right side is situated vertically). MII no. 68 (three signs on the right side are compressed), no. 325 (five signs on the right side are somewhat compressed, placed close to one another, the third sign on the right being diminished in size). Sign no. 111 may serve as a characteristic example; this sign is quite frequently situated on the right side of the lines or, it is the only sign on the seals. For example, MII nos. 84, 588, 704, H. no. 298. In the lines occupying the whole matrix (which just barely fit on the seal), the sign no. 111 which is situated on the right side is distorted through lack of space (the supplementary element is on a slant), e.g., MI no. 306, MII nos. 306, 463, 593:

[1] [G. R. Hunter, *The Script of Harappa and Mohenjo-daro and its Connection with Other Scripts* (London, 1934).]

[2] [See G. R. Hunter.]

8. On some of the seals, the final last signs (situated near the tail of the creature) were not accommodated in the same line with the other signs, and were dropped below; e.g., MI no. 52. The sign no. 87 which usually stands as the last sign on the right, has been dropped below for lack of space. The sequence of the last three signs, nos. 8–96–87, seems to be constant; and where there is enough room all signs are written in a single line. For instance, MI nos. 222, 300, 433; MII nos. 160, 263 etc. On the seal MI no. 247, the last sign on the right in the upper line (no. 118) is considerably diminished in size, and the two following signs form the second line, which is written from right to left (boustrophedon) from the tail to the head of the creature, and is ended by sign no. 78.

The last four signs 237–119–48–87 on the second seal (MI no. 139) are written in one line since there is enough free space; nevertheless, even here sign no. 119, which is quite broad, is placed almost vertically, for economy of space, (Compare MI nos. 54, 201, and 322, and MII nos. 159, 511, and 680 for the more usual manner of rendering sign 119.) Sign no. 30, which stands on the right side of a number of seals, is also somewhat squeezed or [alternatively] is situated in the lower line (MI no. 554; MII no. 373).

In both cases, the last three signs are 175–124–30; the same sequence of signs is written in one line if there is sufficient space (e.g., MI nos. 387, 534). Seal MII no. 660 has one line of text with the end-signs 8–96–87–30; on seal MII no. 312 with the same final signs, sign 30 is transferred to the second line because of lack of space. On seal MI no. 341, sign 30 appears in the second line for the same reason.

9. One may conclude from what has been outlined above, that the signs on the seals were written from left to right (on the sealings from right to left) from the head of the animal to its tail. For want of space, the signs occurring on the right were compressed, or transferred to the second line. Distortion of the signs occurring on the left is not evident. These signs as a rule, are written, calligraphically, most clearly. On the seals with short lines occupying a portion of the field of the seal, the free space remains on the right side of the line (on the left of a sealing), e.g., MII nos. 142, 153, 616; XCIII, 4; X nos. 9,93. Analogously, on the Indian seals with short inscriptions in Kharoṣṭhi written from left to right, the free space remains on the right (i.e., on the left of the sealing).

10. Thus, with the exception of a few cases (cf. MII nos. 8, 321, 512, 520, 651), on the sealings (as was shown above, the photographs of the sealings rather than the seals themselves are almost always what are produced in publications), on copper plates, ivory cylinder seals, ceramics, and tools, the first line is to be read from right to left (on the seals from left to right).

The establishment of the direction of the writing has enabled scholars to determine the orientation of signs which are assymetric in relation to the verti-

cal axis, which in turn enabled scholars to determine the direction of the reading of the inscriptions on those seals where the image of a creature is missing: Two signs (nos. 68, 97) occur in inscriptions in the normal position as well as in a mirror-like reflection (cf. MII 10 and 224; 118 and 237) [i.e., mirror-image].

11. In some cases the line on the seal is given, not in a mirror-image (as it should be on the seals), but [rather] directly, i.e., from right to left. The image of the animal on such seals is positioned so that the head is on the right and not on the left, as on the other seals. In such cases, one must read the line from the head of the animal to its tail (MI no. 167; MII nos. 8, 512, 520, 651).

12. One should take into consideration especially those cases in which the animal on the seal is oriented with his head to the right, but the line is written normally, i.e., from left to right. In these instances, as an exception, the line is to be read from the tail to the head of the animal (MI nos. 112, 272, 302, 341, 376; MII nos. 279, 547, 644, 663, 684; X no. 617).

13. In the inscriptions composed of two or three lines, the second and third lines on the sealings read again from right to left, with the exception of MI no. 247 where as mentioned above the second line on the sealing reads from left to right (boustrophedon).

14. On the seals with representational scenes, the signs are sometimes spread throughout the matrix of the seal because there is no space for lines. The sequence of the signs can be established by analogy with other texts and by considering the stable combinations; e.g., on the seal MI no. 355, the signs follow the sequence 47–100–87–30.

15. In a few instances, isolated signs (usually in the middle of the seal) occur conjointly with lines of signs on the same seal. These are the signs 30, 128B, 219, 233, 287.

COMMENTARY

1. Alekseev concerns himself primarily with the question of the direction of the writing, which he concludes is clearly from right to left. His conclusion is based on the arrangement of the symbols on the majority of seals. First, noting that when a line of symbols does not completely fill the space for a full line the space left free would usually come at the end of that line, he observes that this free space occurs on the left on seals, on the right on sealings. Second, when there is insufficient space for a line of symbols, compression or distortion of the symbols will also occur at the end rather than at the beginning of a line, and this compression, running together, or reduction in size of presumably final symbols occurs in fact at the right on the seals themselves, and at the left on the sealings. (He notes analogous occurrences in Kharoṣṭhi, also written from right to left.) The editors concur in the conclusion that the writing is for the most part intended to be read from right to left and offer in confirmation the

concurrence of B. B. Lal of the Archaeological Survey of India, who reached the same conclusion by different means, namely through an analysis of the position of symbols on a seal with three inscribed sides. Mr. Lal demonstrates rather conclusively that the writing must have been from right to left. A further confirmation is also offered by Lal in the analysis of the inscription on several sherds which show the order of incision of the signs most clearly.[1]

2. One finds oneself less pleased by Alekseev's methods of estimating the number of signs of the Proto-Indian script. His estimate of the number of distinct signs is approximately 350 signs plus an additional 100 allographs which he asserts are the result of addition or subtraction of "decorative elements" and/or simplifications of signs. The editors, though generally in agreement with the approximate number of signs must wonder how Alekseev knows or decides whether an element is decorative? There are many extant scripts, Oṛiya and Cuneiform, for example, where the very slightest, minute – to the untrained eye – change results in an entirely different sign. A casual observer might similarly, erroneously, consider these minute changes to be "decorative elements" as well: for example the signs in Oṛiya ଚ and ବ differ only barely perceptively yet they designate entirely different sounds, [cɔ] and [bɔ]. How can Alekseev be so sure that the variations he so readily discounts are merely allographs? The script, as yet unreadable,[2] may be quite complex and certainly such "allographs" might turn out to be anything from determinatives, vowel markers, or grammatical designations to fully distinct signs. In any case, Alekseev offers the reader no analysis of the script, no grids, in short, no concrete support for his contention.

Similarly incautious are his remarks regarding the two varieties of the script which he designates as 'ordinary' and 'cursive'. The question of an historical or a real relation between the two variants is certainly not impossible, but Alekseev nowhere addresses himself to such a possibility. At the present juncture one would not wish to make a final decision based on the existing evidence; Alekseev's assertion that the variants represent two contemporary styles is without solid foundation, though it can be entertained as one possible explanation.

He quite correctly, in the opinion of the editors, points out the drawbacks of the existing compendia with reference to their inclusion as independent signs of many signs which are probably allographs (e.g., sign 234, 240 of Langdon's compendium). Conversely, occasionally in Hunter's compendium, completely

[1] See B. B. Lal, "The Direction of Writing in the Harappa Script", *Antiquity* IX (1966) pp. 52–55.

[2] As of February 25, 1969 there was an announcement by scholars at the Scandinavian Institute of Asian Studies of success in breaking the script but from a preliminary reading it appears to contain serious drawbacks. See Zide and Zvelebil, *Language* 46, no. 4 (1972), pp. 952–968 for a full review of that attempt.

differing signs are given as allographs, and in both compendia there are some signs missing (omissions of course, compounded by the discovery of new sites in recent years).[3] He notes and illustrates the fact that there appear to be many stable combinations of signs. His consideration of the stable combinations of the signs may also be considered as being in his favor, though he does not go so far as he might after estimating the number of signs and discussing the combinations. He really offers us conclusions only on the direction of the writing. But the conclusion he reaches is based on sound reasoning and is commendable. (As we have noted above, this conclusion is confirmed elsewhere by different methods.)

In general, this is one of the better papers in the first collection. The presentation, though somewhat awkward in diction on occasion, and sporadically lacking in documentation, employs basically good linguistic procedures, such as the sign count, but does not follow through as far as it might have in analysing the function of the various – obviously differing – types of signs in the script.

[3] There is a forthcoming revised compendium of signs to be published by Asko and Simo Parpola of the Scandinavian Institute of Asian Studies, Copenhagen. The best and most comprehensive compilation we have come across has been made by Iravatham Mahadevan with the aid of the Tata Institute of Fundamental Research (Bombay). (Unpublished MS.)

MACHINE METHODS OF INVESTIGATION OF THE PROTO-INDIAN TEXTS

M. A. PROBST

The Proto-Indian texts studied contained approximately 6,300 symbols. These texts were extremely short strings of symbols (about ten symbols per string), without any division into word forms. (In the articles by Kondratov, Knorozov, and Volčok, the Proto-Indian texts are described in more detail.)

Because the Proto-Indian texts were of an extremely small number; because they were represented in the form of short strings; and because it was not even approximately known to which linguistic group the Proto-Indian texts might belong, the following procedure for examining them was formulated:

It was necessary to establish the kind of script in which the Proto-Indian texts were written and to analyse the construction of the texts in order to determine the linguistic group to which the language of the Proto-Indian texts belonged.

The problem of fully deciphering (the reading and translation of an unknown text) the Proto-Indian texts could not be raised without having fully and conclusively solved the problem of the clarification of the construction of the texts. Only now, when that problem has been partly clarified, is it possible to demonstrate the manner of solving the decipherment problem: however, the extremely small volume of texts does not give great hope of fully solving this problem.

The Proto-Indian texts were written in digital transcription in the following way:

A catalog of symbols used in the Proto-Indian texts was prepared; then, each symbol in the text was replaced by the ordinal number for that symbol in the catalog of signs. A digital transcription is extremely important in making possible the use of an electronic computer for processing the texts. In what follows, we will give a step-by-step description of the solution of the problem of elucidating the types of text and their structure employing computer techniques.

1. DETERMINATION OF THE TYPE OF WRITING SYSTEM

The different methods for transcribing human speech can be divided into two classes; the first class includes those types of writing in which the basic principle [underlying] the transcription of human speech is the phonetic, acoustic method. This first type includes infra-phonemic, phonemic, and syllabic types of scrips.

The second class includes all types of scripts where the basic principle of the transcription of human speech is the principle of meaning; that is, the transmission of human speech by some meaningful units. To this class belong the morphemic (hieroglyphic) script and pictographs. From another point of view, we can classify various types of script, not according to the type of transmission of human speech, but according to the quantity of different symbols which are used in a given type of speech transmission. In this case, we can represent the different types of script diagrammatically, in the following way:

Infra-phonemic writing	Phonemic writing	Syllabic writing	Morphemic writing	Pictographic writing
0	10–15	50	100	500–700

(On the axis is given the number of different symbols in the system of writing.) (It is necessary to point out that the boundaries between types of script often vary greatly, sometimes as much as $\pm 30\%$) . . .

In the investigation of unknown historical systems of script, the major difficulty lies in the fact that the texts occur in extremely small volume.[1] Therefore we cannot maintain that in an investigated text all symbols occur which are used in a given type of script.[2]

For the classification of the type of script we shall investigate the function $\omega(l)$, which establishes the relation between the length of text l (where by length l we mean the number of all symbols occurring in the text or in some [consecutive] portion of it) and the quantity of different symbols occurring from the beginning of the text up to the lth symbol.

The behaviour of the function $\omega(l)$ will be of particular interest to us.

If in the investigated text T the function $\omega(l)$ is limited by a constant A_T, so that the length L of the entire text T is greater than twice A_T, then we shall presuppose that the minimum of these constants A_T enables us to demonstrate

[1] [? Cuneiform].

[2] [This is not necessarily true, especially in such historical scripts as cuneiform which contain great amounts of data.]

the type of script which is most probably being used in the writing under investigation. If $\omega(l)$ increases as l increases, and if the increase of $\omega(l)$ is nearly linear, then most probably this means it is a pictographic script. If $\omega(l)$ increases, but its rate of increase beginning at some moment is considerably less than the rate of increase of the linear function, then the script being analysed can be regarded as a morphemic type of writing.

To solve the problem of determining the type of script, a computer program was written; the program contained approximately 150 single address instructions. The following texts were analysed:

(1) Text M: a certain group of Proto-Indian texts containing approximately 700 symbols;
(2) Text F: the Phaistos Disk containing about 250 symbols;
(3) Text K: a portion of the Coptic text, "The Epic of Alexander" containing about 250 symbols;
(4) Text R: the entire text of "The Epic of Alexander" containing approximately 8000 symbols;
(5) Text E: the Rapanui folkloric text, "Te Kanaha", containing ca. 6500 symbols.

For operation of the program, an integer $h > 1$ was assigned and the entire text was split into segments each containing h symbols.

The program calculated the frequency of each symbol in a segment of length h, from which it was [then] quite simple, on the basis of the table of all frequencies obtained, to calculate the value of the function $\omega(l)$ at the points h, 2h . . ., $\left[\frac{L}{h}\right]$h, where L is the total number of symbols in the text, and $\left[\frac{L}{h}\right]$ the polynomial part[3] of $\frac{L}{h}$.

Every text was assigned a digital transcription, and nothing more was imparted regarding the text during the running of the machine experiments. As a result of the running of the program, the texts were classified in the following way:

Text K: A phonetic type of writing
Text R: A phonetic type of writing
Text F: Morphemic Script
Text M: Morphemic Script
Text E: Morphemic Script.

[3] [The Russian has *tselaya čast'*, i.e., lit. 'the whole part'.]

2. INVESTIGATION OF THE CONSTRUCTION OF THE PROTO-INDIAN TEXTS

The basic role of the investigation was to elucidate fundamental properties of the text which would enable [one] to reconstruct, at least partially, the grammar of the Proto-Indian language.

Below we will give an exact definition of what is meant by 'Description of the construction of the text': and we will describe the algorithm for obtaining the 'description of the construction of the text'. To do this, we need to introduce a number of concepts and definitions.

Let there be a set $A = \{a^j\}$, $j = 1, 2, \ldots, n$, such that when $a^{j_1} = a^{j_2}$, then $j_1 = j_2$. The set A we shall call the generating set, or alphabet.

We shall investigate the finite sequence T, consisting of the elements of the generating set A:

$$S_1S_2 \ldots S_i \ldots S_N.$$

Let $\alpha(S_i)$ be a function defined by the elements of the sequence T, the range of whose values is the generating set A:

$$\alpha(S_i) = a^j.$$

The function $\alpha(S_i)$ determines which element of the generating set A occurs in the i th position of the sequence T. We shall call the sequence T, Text T.

All sequences and sets analysed below have a finite number of elements.

Definition 1

We shall call some permutation of τ elements of the sequence, the transformation defined by the sequences composed of k elements.

If there are two sequences, $\beta = (\beta_1\beta_2 \ldots \beta_i \ldots \beta_k)$ and $\gamma = (\gamma_1\gamma_2 \ldots \gamma_j, \ldots \gamma_k)$ and the permutation τ over the indexes i and j transforming the sequence β into the sequence γ, is given, then we will say that the transformation τ is given and from the fact $i \rightarrow j$ (β_i is transformed into γ_j) it follows that $\beta_i = \gamma_j$.

In this case we will use the notation $\tau(\beta) = \gamma$.

We will investigate only those sets of transformations in which together with the transformation τ there is always present the inverse transformation τ^{-1}.

Definition 2

Let there be given some set of transformations $\tau = \{\tau_v\}$, where $v = 1, 2, \ldots$. We will say that two strings $\beta = (\beta_1\beta_2 \ldots \beta_k)$ and $\gamma = (\gamma_1\gamma_2 \ldots \gamma_k)$ τ are equivalent if there exists the transformation $\tau_v \epsilon \tau$, where $\tau_v(\beta) = \gamma$. In the opposite case, the sequences $\beta = (\beta_1, \beta_2 \ldots \beta_k)$ and $\gamma = (\gamma_1, \gamma_2 \ldots \gamma_k)$ we will call τ, nonequivalent strings.

We will examine an element x which does not belong to the generating set A; this may be substituted for any element $S_i \in T$, $1 \leqslant i \leqslant N$. The group of subsets containing the elements x, we will designate by χ.

Definition 3

The value of the index i of the element $S_i \in T$ we will call the ADDRESS of the element S_i in the text T.

Definition 4

We will call the portion of the text T from the element with address i to the element with address $i + l$ inclusive, in which the elements $S_{i+l_1}, S_{i+l_2}, \ldots, S_{i+l_m}$ are replaced by the element x (it is clear that $l \leqslant l_1 < l_2 < \ldots < l$) a type-one configuration K_1 $(i, l, l_1, l_2, \ldots, l_m)$.

It may turn out that in the type-one configuration many elements x exist which are in contiguous groups. In this case, we have to indicate that there are too many l_m and the transcription of the type-one configuration turns out to be very unwieldy. When using the designation χ for the groups of contiguous x we obtain definition 5.

Definition 5

We will call a type-two configuration $K_2(i, l, l_1, \omega_1, \ldots, l_m, \omega_m)$ segment of the text T starting with the element with address i up to the element with address i + 1 inclusive, in which the groups of elements from S_{i+l_1} to $S_{i+l_1+\omega_1}$ from S_{i+l_2} to $S_{i+l_2+\omega_2}, \ldots$, from S_{i+l_m} to $S_{i+l_m+\omega_m}$ are replaced by χ.

Definition 6

The number of elements of a string which makes up the configuration we shall call the length of the configuration.

Definition 7

The portion of the Text T from elements with address $i - r$ to the element with address $i + r$ inclusive, we will call the environment ε (r, i) of the radius r of the element $S_i \in T$. If $i - r < 0$ or if $i + r > N$, then in place of the 'missing' elements of the text T we will write, in the needed amount, the elements x.

Definition 8

We shall call the string $\pi = (\beta_1, \beta_2 \ldots, \beta_i \ldots, \beta_{2r+1})$ the intersection of two environments $\varepsilon(r, i_1)$ and ε (r, i_2): this was arrived at as follows:

Let S_{i_1-r+k} T and S_{i_2-r+k}, T, where $k = 0, 1, \ldots, 2r$, $i_1 < i_2$. Then, if $\alpha(S_{i-r+k}) = \alpha(S_{i-r+k}) = \alpha(S_{i_2-r+k})$, [then] $\beta_K = S_{i_1-r+k}$, where $k = 0, 1, \ldots, 2r$. But if $\alpha(S_{i_1-r+k})$ $\alpha(S_{i_2-r+k})$ then $\beta_k = x$ where $k = 0, 1, \ldots, 2r$.

Let there be three sets of strings composed of the elements of the generating set $A\gamma = \{\gamma_l\}$ $\beta = \{\beta_K\}$ and $\delta = \{\delta_S\}$, where $\gamma_l = a^{j1}\, a^{j2} \ldots a^{j}i$, $\beta_k = a^{\gamma' 1} a^{\gamma' 2} \ldots a^{\gamma' k}$, and $\delta s = a^{j'' 1} a^{\gamma'' 2} \ldots a^{\gamma''}S$. Let us call 'the γ-block' some string composed of the elements of the sets γ, β and δ, which has the form

$\beta i_1\, \beta i_2 \ldots \beta i_S \gamma i\; \delta i_1'\; \delta i_2' \ldots \delta i_k'$, where $S = 0, 1 \ldots; k = 0, 1, \ldots$

The two γ-blocks $\beta_{i_1}\beta_{i_2} \ldots \beta_{i_S}\gamma_i\delta i_1'\delta i_2' \ldots \delta_{i'_k}$, and $\beta j_1 \beta j_2 \ldots \beta_{jl}\gamma_j\delta_{j2}' \ldots \delta j'm$, where $s, k, l, m = 0, 1, \ldots$, we shall consider equal if $l = s$, $m = k$ and $\beta i_1 = \beta j_1$, $\beta i_2 = \beta j_2, \ldots, \beta i_S = \beta j_1$, $\gamma i = \gamma j$, $\delta_{i_1}' = \delta_{j_1}', \ldots, \delta_{i_k}' = \delta_{j_m}'$.

Let us introduce the symbol *. The symbol *, written in the string after any of the γ-blocks, indicates that two or more symbols written in the string successively one after the other [sic], are identical to the data of the γ-blocks.

Let us examine some finite aggregate strings composed of γ-blocks. We describe the formation of a specific type of string, obtained from those strings programmed earlier.

1. Let there be in a given string two or more identical γ-blocks located side by side. In this case we retain in the string only the first γ-block (counting from the beginning of the string); we write after it the symbol * and we eliminate all identical γ-blocks.

We will make these transformations in all given strings. We will say that the transformed string describes the structural properties of the original string.

2. We shall consider two strings as congruent if they are composed of identical γ-blocks and *, written in the same order.

Out of all transformed strings (see Section 1.) we will retain only the incongruent strings and arrange them in increasing order of the number of γ-blocks; we will [then] assign numbers to them. We obtain an ordered set $M = (M_1 M_2 \ldots M_i \ldots M_z)$ where the index i is the number of the string in the set M.

3. Let there be in the set

$$M = (M_1 M_2 \ldots M_z)$$

two strings

$$M_i = (m_1^i m_2^i \ldots m_l^i m_{l+1}^i \ldots m_{l+k}^i \ldots m_n^i),$$

and

$$M_j = (m_1^j m_2^j \ldots m_k^j),$$

where m_u^i and m_v^j are either γ-blocks or *.

Then, if

$$m_{l+1}^i = m_1^j,\; m_{l+2}^i = m_2^j \ldots,\; m_{l+k}^i = m_k^j, \tag{1}$$

we substitute M_i for the string $\overline{M}_i = (m_1^i m_2^i \ldots\ldots\ldots m_l^i j m_{l+k+1}^i \ldots m_n^i)$, where j is the number of the string M_j.

4. The set $M = (M_1 M_2 \ldots M_z)$ is constructed from the set $\overline{M} = (\overline{M}_1 \overline{M}_2, \ldots, \overline{M}_z)$ in the following manner:

Let a portion of the set $\overline{M}$ be already constructed. Take some $M_j \in M$ and moving along the set M in increasing order of the string numbers search for that string M_i in which condition (1) is fulfilled.

If such $M_i \in M$ is found, then taking $\overline{M}_i \in \overline{M}$, we verify the condition (1) for $\overline{M}_i$ and M_j. If condition (1) is satisfied then we change $\overline{M}_i$ as demonstrated in paragraph 3. This new $\overline{M}_i$ we write down in $\overline{M}$ instead of the previous $\overline{M}_i$. Further, we proceed to the sequence M_{i+1} and we verify condition (1) for it.

If condition (1) for $\overline{M}_i$ and for M_j is not satisfied then we take the string M_{i+1} and verify for it the validity of condition (1).

When the entire set M has been examined in this way, we proceed to $M_j + 1$ and repeat the same process which was used with M_j.

Before the start of the process $\overline{M} = (M_1M_2 \ldots M_z)$, i.e., $\overline{M} = M$ and $j = 1$.

The process of establishing the set $\overline{M} = (\overline{M}_1 \ldots \overline{M}_z)$ ends when $j = z$.

5. Let there be in the set $\overline{M} = (\overline{M}_1\overline{M}_2 \ldots M_z)$ two strings

$$\overline{M}_i = (m_1^i m_2^i \ldots m_k^i N^i m_{k+1}^i \ldots m_n^i)$$

and

$$\overline{M}_j = (m_1^j m_2^j \ldots m_k^j N_j m_{k+1}^j \ldots m_n^j),$$

where m_u^i and m_v^j are γ-blocks or * and N_i and N_j are a group of numbers or a series of a group of numbers obtained as a result of the procedure described in 4.

Then, if

$$(2) \qquad m_1^i = m_1^j,\ m_2^i = m_2^j,\ \ldots,\ m_k^i = m_k^j + m_{k+l}^i = m_{k+l}^j \ldots$$

$m_n^i = m_n^j$ and $i < j$, we replace the strings $\overline{M}_i$ and $\overline{M}_j$ by the string

$$M_i = (m_1^i m_2^i \ldots m_k^i N_i N_j m_{k+1}^i \ldots m_n^i).$$

Using a procedure analogous to the one in 4, we are able to obtain from the set $\overline{\overline{M}}, = (\overline{\overline{M}}_1\overline{\overline{M}}_2 \ldots \overline{\overline{M}}_{z_1})$, where $z_1 \leqslant z$.

6. Let there be two strings belonging to the set $\overline{\overline{M}}$. We will consider these strings as congruent if they are composed of the same γ-blocks and series of groups of numbers (the order of the groups in the series is irrelevant) and if the γ-blocks, *, and the series of the groups of numbers are written in the same order. Then, out of all the strings $\overline{\overline{M}}_i \in \overline{\overline{M}}$ we will retain only the incongruent sequences.

Definition 9

Let there be a set of strings composed of γ-blocks. Then, we shall call the set of strings constructed from the data by the application of rules 1—6, the ensemble[4] of γ-structured strings corresponding to the given set of strings.

[4] [Here the Russian has *sovokupnost'*.]

We will consider the following hypotheses necessary to the selection and establishment of an algorithm for examining the structure of the text, appropriate for a text T.

3. HYPOTHESIS 1: THE LOCALNESS [sic] OF THE STRUCTURE

It is possible to break a text T into a system of intersecting sub-texts $P_1, P_1 \subset T$ so that:

(a) the text T may be symbolized as a string composed of subtexts P_1, each of which is, in its turn, a string composed of the elements of a generating set A. We can obtain the structural properties of each sub-text $P_1 \subset T$.

(b) We will examine the whole text T as one string and obtain a description of the structural properties of the text T.

THEN, THE STRUCTURAL PROPERTIES OF THE TEXT T ARE CONGRUENT WITH THE STRING OF STRUCTURAL PROPERTIES OF THE SUB-TEXTS P_1.

The structural properties of the text T do not describe all structural properties of a text nor do they fully describe the structure of the text T.

By the description of the structure of the text T we shall understand the following:

Let the text T be given. It is assumed that we can construct three sets $\Phi = \{f_t\}$, $K = \{k_s\}$ and $\tau = \{\tau_v\}$, satisfying the conditions:

(a) The elements $f_t \in \Phi$ and $k_s \in K$ are strings formed from the elements of a generating set A and are parts of the sub-texts P_1.

(b) The set Φ can be divided into two subsets Φ_1 and Φ_2, $\varphi = \varphi_1 \cup \varphi_2$, $\varphi_1 = \{f_{t'}\}$ and $\varphi_2 = \{f_{t''}\}$, where $f_{t'}$ and $f_{t''}$ mean the element of the sets φ_1 and φ_2, respectively.

(c) The entire text T and, consequently, any sub-text P_1 may be written as a string composed of the elements f_t and k_s.

(d) The sets Φ and K can be divided into sub-sets $\varphi \subset \Phi$, $\Phi = \cup\varphi$ and $k \subset K$, $K = \cup k$ and each subset $\varphi \subset \Phi$ corresponds to the subset $k \subset K$. At the same time the set K is divided into intersecting subsets k.

(e) Any $P_1 \subset T$ can be written as a k–structured string composed of k-blocks, * and groups of numbers (where k are blocks composed of k, $f_{t'}$, and $f_{t''}$ while the role of $\gamma = \{\gamma_l\}$ is played by the set $K = \{k_l\}$; the role $\beta = \{\beta_k\}$, by the set $\varphi_1 = \{f_{t'}\}$ and the role $\delta = \{\delta_s\}$, by the set $\varphi_2 = \{f_{t''}\}$).

(f) The set τ is a set of transformations of k-structured strings. Let us then examine the entire sum of k-structured strings obtained for all $P_1 \subset T$.

We can select classes of τ-equivalent k-structured strings fulfilling the following two conditions:

(1) two k-structured strings α and β belong to one and the same class if it is possible to find k-structured strings $\alpha_1, \alpha_2, \ldots, \alpha_v$ belonging to the same class

and transformation τ_{i_0}, $\tau_{i_1} \ldots$, τ_{i_ν} so that

$$\tau_{i_0}(\alpha) = \alpha_1$$

$$\tau_{i_1}(\alpha_1) = \alpha_2$$

$$\tau_{i_\nu}(\alpha_\nu) = \beta$$

(2) Every two k-structured strings belonging to different classes will be τ-non-equivalent.

Definition 10
Each class [of] τ-equivalent k-structured strings shall be called the τ-structure of the text T.

Definition 11
We will say that a description of the structure of the text is given if the sets Φ, K, τ are known and the aggregate of τ-structures of the text T is given (i.e., the factor-set of the entire set of k-structured strings of the text T with respect to the set τ). By such a description, different sub-texts P_1 can designate one and the same τ-structure.

4. HYPOTHESIS 2

We assume that a non-trivial description of the structure of the text T is possible; i.e., a description such that among the elements of the sets Φ and K, are found those elements which do not belong to the generating set A.

The description of the structure of the text is closely related to general linguistic conceptions. Thus the set Φ can be considered to be a set of affixual morphemes, the set K as a set of root-morphemes, the set τ (the set of transformations) as a set of those transpositions of words in an utterance which are permissible in a given language and the sum of τ structures gives a set of those types of sentences of an investigated text which are composed of different words.

Thus, knowledge of the structure of a text enables us to disclose the grammatical markers of the analysed language.

In the problem of the investigation of an unknown text, written in an historical type of script, knowledge of the structure of the text is decisive because this enables us to find the nearest linguistic group and to draw phonetic and semantic parallels from comparison with known languages.

Naturally, it is not possible to give a description of the structure of any text with all details. If the volume of data is extremely small and if there is no corroborating evidence (bilinguals, etc.), then the attempts at a full description of the structure of the text and its decipherment are destined to be futile.

An ancient Egyptian text (a portion of the "Legend of Sinuhe") was processed according to the algorithm given below for describing the structure of a text; the text contained 1650 symbols, which was merely double the number of symbols used in Ancient Egyptian writings.

The text was treated as if it were an unknown text without division into blocks.

As a result of the processing of the machine data, it was possible to divide the text into blocks and morphemes and to find several types of sentences. With a text of such small volume it is possible to investigate in a parallel fashion both the morphological and syntactical markers of a text; this possibility was provided for in the algorithm.

Below, we give a description of the algorithm for constructing a description of the structure of the text

$$T = (S_1S_2 \ldots S_i \ldots S_N).$$

We will select an integer $r > 1$ and examine the set of all vicinities ε (r, i), $i = 1, 2, \ldots, N$.

For each vicinity ε (r, i), $i = 1, 2, \ldots, N$, we shall obtain intersections of that vicinity with vicinities ε (r, i + 1), ε (r, i + 2), . . ., ε (r, N).

We will study the set of intersections obtained including all vicinities ε (r, 1), ε (r, 2), . . ., ε (r, N).

Our aim is to present a classification of different types of intersections and with the help of that classification to obtain a description of the structure of the text T.

If β_u is an element of the intersection P_1, and γ, an element of the intersection P_2 and $\beta_u = S_{i_u} \epsilon T$ and $\gamma_v = S_{i_v} \epsilon T$, then we will say that $\beta_u = \gamma_v$ if $i_u = i_v$ whence it follows that $\alpha(Si_u) = \alpha(S_{i_v})$.

We will consider two intersections $P_1 = (\beta_1, \beta_2 \ldots, \beta_l, \ldots, \beta_{l+m}, \ldots \beta_n)$ and $P_2 = (\gamma_1\gamma_2 \cdots \gamma_{l_1} \cdots \gamma_{l_1+m} \cdots \gamma_{n_1})$ as identical, if

$$\beta_1 = \gamma_{l_1}$$

$$\beta_{1+l} = \gamma_{l_1+1}$$

$$\beta^l{}_{+m} = \gamma_{l_1+m}, \text{ where}$$

$$\beta_1 \beta_2 \ldots, \beta_{l-1}, \beta_{l+m+1}, \ldots, \beta_n \text{ and}$$

$$\gamma_1, \gamma_2 \ldots, \gamma_{l_1-1}, \gamma_{l_1+m+1}, \ldots, \gamma_{n_1}$$

are all elements of x.

Let there be two intersections $P_1 = (\beta_1, \beta_2 \ldots \beta_l\beta_{l+1}, \ldots \beta_m)$ and $P_2 = (\gamma_1 \cdot \gamma_2 \cdots \gamma_k\gamma_{k+1} \cdots \gamma_{k+1})$, where γ_i and β_j either belong to the text T or are the elements of x. Let there be, in addition, among the elements $\gamma_{k+1}, \gamma_{k+2}, \ldots \gamma_{k+l}$ and $\beta_1, \beta_2 \ldots \beta_l$ elements not equal to x.

By intersections with a common segment we mean such intersections as $P_1 = (\beta_1, \beta_2, \ldots \beta_l, \beta_{l+1}, \ldots, \beta_m)$ and $P_2 = (\gamma_1, \gamma_2, \ldots \gamma_k, \gamma_{k+1}, \ldots, \gamma_{k+l})$ for which the following relations are valid:

$$\beta_1 = \gamma_{k+1}$$

$$\beta_2 = \gamma_{k+2}$$

$$\beta_l = \gamma_{k+l}$$

The intersection $P_1 = (\beta_1, \beta_2 \ldots \beta_m)$ is said to be embedded in the intersection $P_2 = (\gamma_1, \gamma_2 \ldots \gamma_l, \gamma_{l+1} \ldots, \gamma_{l+m} \ldots \gamma_n)$ if the following relations are valid:

$m < n$ and

$$\beta_1 = \gamma_{l+1}$$

$$\beta_2 = \gamma_{l+2}$$

$$\ldots\ldots$$

$$\beta_m = \gamma_{l+m}$$

In order to diminish the sum of intersections obtained for the text T we perform the following operations:

(1) For each intersection P_i we exclude from our consideration all intersections $P_{i_1}, P_{i_2} \ldots P_{i_m}$, which are identical with the intersection P_i.

(2) Every two intersections $P_1 = (\beta_1, \beta_2, \ldots, \beta_l, \beta_{l+1}, \ldots, \beta_m)$ and $P_2 = (\gamma_1, \gamma_2, \ldots, \gamma_k \gamma_{k+1} \ldots \gamma_{k+l})$, which are intersections with a common segment we replace with one intersection $\pi = (\gamma_1, \gamma_2, \ldots \gamma_{k+1}, \beta_{l+1} \ldots, \beta_m)$.

(3) If the intersection P_1 is embedded in the intersection P_2 and it is not encountered outside of the intersection P_2 in the text T then we exclude the intersection P_1 from consideration.

Thus, we will substantially diminish the number of intersections submitted to investigation and obtain the configurations of the first class. In order to obtain the configurations of the second class, it is necessary to "compress with respect to x" the configuration of the first class; i.e., to substitute χ for the string of elements x.

We will say that two configurations $\gamma_1, \gamma_2, \ldots, \gamma_l, \gamma_{l+1} \ldots\ldots, \gamma_{k+l}, \ldots, \gamma_n$ and $\beta_1, \beta_2, \ldots, \beta_{l_1}, \beta_{l_1+1} \ldots, \beta_{l_1+k} \ldots, \beta_{n_1}$ are congruent if

$$\gamma_{l+1} = \beta_{l_1+1}$$

$$\gamma_{l+2} = \beta_{l_1+2}$$

$$\ldots\ldots$$

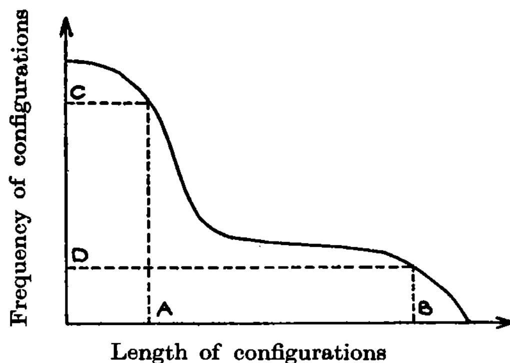
$\gamma_{l+k} = \beta_{l_1} + k$, where γ_i and β_j are elements of the text T or x or χ, β_{l_1} and γ_l, and $\beta_{l_1} + k + 1$ and γ_{l+k+1} are the first and last elements respectively, not

equal to x or χ and the equation $\gamma_u=\beta_v$ means that $\alpha(S_{l_u})=\alpha(S_{i_v})$, if $\gamma_u = S_{i_u} \in T$ and $\beta_v = S_{i_v} \in T$. For each configuration we can find a number of configurations congruent with the one given. This number we shall call the frequency of configuration.

Thus, to each configuration will correspond its frequency (the number of congruent configurations); further, we will consider only incongruent configurations. We will assume that for the text T the following hypothesis is valid:

5. HYPOTHESIS 3

We will arrange all incongruent configurations obtained from the text T in the order of decreasing frequency. Then, the distribution of the configurations according to frequency has the shape



Thus all configurations are divided into three groups according to their frequency:

(1) Configurations of a length $\leqslant$ A and frequencies $\geqslant$ C.

(2) Configurations whose length changes within the segment [A, B] and which have a frequency $\geqslant$ D, but $<$ C.

(3) Configurations having a length $>$ B and a frequency $<$ D.

We describe the process of classification of the configurations, based on the validity of hypothesis 3.

6. CLASSIFICATION OF CONFIGURATIONS

(a) We will examine configurations of the first type which have a frequency $\geqslant$ C. We will compare, with each configuration K^1, a set of configurations K/K^1 such that if the configuration $K \in K/K^1$, then K^1 is embedded in K.

(b) From among those configurations investigated, we select first the configuration K^1 in the configurations K/K^1 so that this configuration takes certain

restricted positions, i.e., that the configuration K^i in the configurations $K \in K/K^i$ stands only after definite strings composed of the elements of the generating set A.

Second, so that it is possible to select, out of all configurations satisfying the condition a), a group (or groups) of configurations such as $K^{i_1}, K^{i_2}, \ldots K^{i_z}$, so that $\mathop{p}\limits_{t=1}^{z} K/K^{i_t}$ would only be slightly different from the set

K/K^{i_l} $l = 1, 2, \ldots, z$, where P is a set-theoretical intersection (by "slightly" we mean the following:

if $A = \mathop{p}\limits_{t=1}^{z} K/K^{i_t}$ and in $\mu(A)$ designates the number of elements of the set A, then

$\mu(K/K^{i_l}) - \mu(A) < \gamma_1 \mu(K/K^{i_l})$, $l = 1, 2, \ldots, z$; $\lambda_1 \in [0,1]$

λ_1 can be selected, e.g., as equal to 1/5).

The configurations K^i, which satisfy the first and second conditions, we relate to type I; and configurations K in which K^i are embedded, to type II.

(c) Among the configurations (prevalently of the second type) we write the type (3) configuration $\beta K^{(1)} \alpha K^{(2)} \gamma$, where $K^{(1)}$ are configurations belonging to type I, $K^{(2)}$ some configurations of the first type; β, α, γ are strings compounded of the generating set A and of the elements x.

We will examine the configurations of type (3) with fixed $K^{(1)}$ and $K^{(2)}$. If in all configurations of that type the length of the string α changes strictly within given limits or the frequency of the configurations with the strings α, the length of which changes within given limits, there are substantially more configurations containing α of arbitrary length; then in that case we refer to type I the configurations $K^{(2)}$ entering into type (3) configurations, and to type II all configurations in which configurations $K^{(2)}$ are embedded.

Then, by means of procedure (c), we complete the sets of configurations of type I and type II. Now we apply procedure (c) to the "new" type I configurations etc. [We start with the configurations which have the highest frequency, figuring that such configurations must contain affixes (since affixes have the highest frequency in comparison with root morphemes). At points (a) and (b) we ascertain whether the given configuration is an affix (or more commonly a 'variable sign') and after having obtained a positive answer at point (c) we search for a new variable sign, analysing the syntactic relations. The chain α has a variable length, caused by the fact that a block can be situated between two variable signs. The length of the chain α fluctuates around the average length of a block.]

Thus, after finishing the process of classifying the configurations we can select the set of configurations of type I and type II out of the entire sum of configurations.

Configurations of type I give the sought-for set Φ. A number of type II configurations without embedded type I configurations gives the set K.

With each element k_s of the set K we compare all elements f_t from a subset Φ which are contained in the same type II configurations as the element K. These elements f_t form a subset φ of the set Φ. The set K we divide into two subsets k so that one and the same subset $\varphi \subset \Phi$ corresponds to the elements of the set K entering into one k. At the same time the set K is broken into intersecting subsets k; the same must be done with the set Φ. We shall divide the set Φ into two subsets Φ_1 and Φ_2 in the following manner:

If the element $f_t \in \Phi$ entering into the type II configuration precedes in that configuration, the element of the set K, then such an element f_t will be referred to Φ_1 and will be designated by f_t'. If, however, the element f_t entering into the type II configuration follows in that configuration the element of the set K, we refer such an element to Φ_2 and designate it by $f_{t''}$. The sets Φ_1 and Φ_2 can have common elements, i.e., those elements which precede as well as follow the element of the set K.

Now we are able to divide the entire text T into k-blocks in the same way in which it was done in § 3 whereby the role $\gamma = \{\gamma_l\}$ will be played by the set $K = \{k_i\}$, the role $\beta = \{\beta_k\}$, and $\delta = \{\delta_s\}$ will be played by the sets $\Phi_1 = \{f_t'\}$ and $\Phi_2 = \{f_t''\}$ respectively.

In order to obtain a full description of the structure of the text T we must obtain the set τ and [the] τ-structures. We will examine the configurations of type (3). We will exclude from them those configurations which are embedding or which have a common segment (analogous to the intersections with a common segment). Thus, we obtain the division of the text T into parts which are, at the same time, subtext(s) P_1 (cf. § 4).

Beginning from the division of the text T into k-blocks, and considering each subtext P_1 as a string composed of k-blocks, we can construct k-structured sequences; at the same time, each subtext P_1 will transfer into some k-structured string. We will divide the entire sum of k-structured strings into classes. Two k-structured strings will be regarded as one class if they differ only in the order of k-blocks, and the order of the chains of numbers. Since within one class the k-structured strings differ solely in order, we can speak of permutations which transform one k-structured string into another of the same class. The total permutations operating in all classes give us, in addition, the sum τ – the sum of all transformations. The sum of all classes of k-structured strings gives us the sum of τ-structures of the text T.

In this way, we can describe fully the structure of the text T since we have built the sets Φ, $K_1 \tau$ and the set of τ structures.

On the basis of what has been outlined above, a program for an electronic computer was prepared and the total of intersections of the Proto-Indian text was obtained.

In programming the intersections, the value of r (the radius of the vicinity) ε (r, i) was selected as equal to 14, because 14 is near the maximum length of the Proto-Indian inscriptions.

The program for the intersections took up about 500 commands of a one-address computer. We selected r > maximum length of a block so that we might employ syntactic connections for clarification of the morphological features (cf. point (c) on p. 35).

Because the memory of the machine was too small to hold all of the intersections, it was necessary to register the obtained intersections on punch cards. The intersections were always shown on punch cards, keeping the element unequal to element x, and the address of the intersection in the text was retained in the memory [of the machine].

To obtain all the intersections of the Proto-Indian text, it was necessary to operate the machine for ca. 80 hours. One should point out that about 30% of the time was taken up with punching the intersections on cards.

The next stage in the processing of the volume of intersections was performed on sorters. A dictionary of intersections was compiled, and during the compilation of the dictionary, all identical intersections were excluded.

Using the dictionary it was then easy to decrease the amount of intersections in the above-mentioned manner (see p. 33 points 1–3).

A more detailed description of the analysis of the intersections is given in the paper by A. M. Kondratov.

To refine and correct the data obtained as a result of the analysis of the intersections, an environmental search program was used. A list of signs or groups of signs were put into the machine and as a result of the operation of the program, as many as seven signs, preceding the datum, were printed out; and as many as seven signs following it. Such a program enabled [us] to make more precise, many of the [more] doubtful results obtained on the basis of work of the programming of the intersections. The environmental search program occupied 200 words of a one-address machine. The results obtained were [then] printed out; the machine was operating at the speed of the printer since all necessary operations were performed between print-out cycles. The analysis of the computer materials obtained, and a further investigation of the Proto-Indian texts is outlined in the papers of A. M. Kondratov, Yu. V. Knorozov and B. Ya. Volčok.

COMMENTARY

In the opinion of the mathematician, Martin B. Powell (Oxford University) and the computational linguist, Henry I. Saxe (University of Chicago), though no new or especially original treatment of this type of data is offered by Probst, the mathematics contained in the preceding paper is quite adequate to the task and apparently well formulated.

THE POSITIONAL-STATISTICAL ANALYSIS OF THE PROTO-INDIAN TEXTS

A. M. KONDRATOV

1. GENERAL INFORMATION

The problems of a positional-statistical investigation of the undeciphered Proto-Indian texts consisted of:

(1) determining the system of the script;
(2) discovering the preliminary referents of the signs;
(3) dividing the texts into blocks;
(4) distinguishing variable and semi-variable signs and determining different classes of root-signs;
(5) determining the combinations into which the variables enter [ed].

A positional-statistic analysis (using computer techniques) was applied to an unsegmented ancient Egyptian text—the beginning of "The Legend of Sinuhe"—(which was treated as undeciphered), the content of which was approximately equal to twice the number of the ancient Egyptian hieroglyphic signs (1,650 signs). Then [the analysis] was applied to the undeciphered and unsegmented Proto-Indian inscriptions (containing more than 6,300 signs).

In connection with the fact that the beginning and end of every Proto-Indian inscription is known, a digital transcription was given for a continuous text. The intent was to investigate artificial polygrams occurring during the process at the junctures between inscriptions in order to discover analogous combinations within inscriptions. The curve of emergence of new signs in relation to the growth of the length of a text in the Proto-Indian inscriptions coincided with the curve of emergence of new signs in ancient Egyptian (cf. Table 1), and it formed in sharp 'overfalls' specific to hieroglyphic systems of writing.

The results obtained fully supported the hypothesis proposed earlier regarding the hieroglyphic character of the Proto-Indian script.

TABLE 1

Frequency of increase of new signs

Number of Signs	Egypt	India	Number of Signs	Egypt	India
25	13	20	725	3	1
50	12	11	750	2	1
75	14	11	775	2	1
100	9	7	800	3	1
125	8	5	825	3	2
150	5	3	850	4	3
175	9	4	875	1	1
200	6	4	900	4	2
225	4	6	925	2	0
250	4	3	950	1	2
275	5	5	975	1	1
300	2	3	1000	1	2
325	4	2	1025	2	1
350	3	6	1050	3	4
375	3	5	1075	5	1
400	6	6	1100	1	0
425	0	7	1125	1	1
450	4	5	1150	2	4
475	2	5	1175	1	1
500	4	2	1200	1	0
525	2	7	1225	1	2
550	1	3	1250	3	0
575	1	2	1275	0	2
600	4	5	1300	0	0
625	3	1	1325	0	1
650	2	3	1350	3	0
675	5	0	1375	0	0
700	3	6	1400	2	2

2. BREAKING UP SIGNS INTO CLASSES

After having computed the absolute frequency of different signs in hieroglyphic texts and arranging them in order of decreasing absolute frequency (Table 2), it is possible to observe different classes of signs in the Proto-Indian texts. In the Egyptian text a considerable number of signs of high frequency express grammatical markers. As a rule, these same signs also perform other functions: they express a part of the root morpheme (e.g., the sign *n* functioning as a marker of the objective case and past tense also serves as the phoneme *n* in

TABLE 2

Different classes of signs

	Egyptian text					India				
Class of Signs	Number of Different Signs	Sum of Absolute Frequencies	Grammatical Function	Combination Grammatical Features	Phonetics	Morphology	Determinatives	Numerals	Number of Different Signs	Sum of Absolute Frequencies
in %	in %	in %	in %	in %	in %	in %	in %	in %		in %
Greater than 10	0	0	0	0	0	0	0	0	1	11.0
8–10	1	0.0	4.0	3.0	2.0	0	0	0	0	0
6–8	1	7.3	3.6	1.2	2.5	0	0	0	1	6.4
4–6	4	19.9	8.9	4.1	4.9	0	2.0	0	0	0
2–4	6	16.4	1.7	2.5	6.2	0	5.4	0.6	4	11.4
1–2	8	10.2	0	0.6	5.7	0	3.9	0	27	36.9
0.5–1	13	10.7	0	0.3	2.2	4.3	3.9	0	13	8.1
0.25–0.5	17	8.0	0	0.2	1.7	3.7	2.4	0	29	10.8
0.1–0.25	40	9.3	0	0.1	0.5	6.6	2.1	0	35	5.1
Less than 0.1	105	9.1	0	0	0.1	6.1	2.3	0	205	10.3
Total:	195	100	18.2	12.4	25.8	21.3	22.0	0.6	315	100

the roots of words; the sign *t* functioning as the marker of feminine gender also functions as the phoneme *t* in roots of words, etc.); they are determinatives (e.g., the sign *j* functioning as the first person singular pronominal suffix can also be the determinative 'man', etc.).

Signs which have low absolute frequency function either as root morphemes or as determinatives or rare phonetic signs.

We can assume, with a high degree of certainty, that, on analogy with the data of the Egyptian texts, among the Proto-Indian signs which have a high absolute frequency, there must be signs functioning as grammatical markers; and among signs with low frequency there must be signs functioning as root morphemes.

3. THE DETERMINATION OF POLYGRAMS

The polygrams of an hieroglyphic text can be accidental or real (we call recurring combinations of signs which do not correspond to any definite units of the language, accidental polygrams). The accidental polygrams are formed at the cost of 'junctions' of parts of a morpheme, a word-form, or a word-combination (the ending of a word and preposition belonging to another word, the ending of a word and the beginning of another word of the same or of a new sentence, and breaks).

Certain units of language encoded in hieroglyphic signs correspond to real polygrams: phonograms with phonic confirmations [sic], affixual and root morphemes (with or without determinative), word-forms, stable word-combinations, and sentences. The longer the polygram, the less likely its accidental formation, and the greater the probability that some linguistic unit corresponds to it.

Thus, there are in the ancient Egyptian texts, 69 purely accidental diagrams [sic],[1] 17 trigrams, 2 tetragrams, and zero pentagrams or greater.

It is probable that the number of accidental polygrams in the Proto-Indian texts decreases approximately in the same proportion as the increase in length of the polygrams. The distribution of the number of real polygrams according to their linguistic referents shows that the morphemes correspond to a great part of the ancient Egyptian digrams, word-forms to trigrams, word-combinations to tetragrams and greater [sic].[2]

(Exceptions are formed by polygrams whose referents are the word-forms which are names of tribes written phonetically with added determinatives.)

However, such distribution of polygrams according to linguistic referents reflects only the structure of the Egyptian language and not the Egyptian hieroglyphics and cannot be directly extrapolated into other unknown hieroglyphic texts encoding some other linguistic structure.

The data from the Egyptian text show that roughly 75% of all polygrams have linguistic referents and only 25% of the polygrams appear to be accidental. These numbers remain true also with regard to unknown texts having the same statistical structure, though the distribution according to concrete linguistic referents will vary with texts written in different languages (the specific features of the orthography will also exert an influence upon the concrete distribution of digrams, trigrams, etc., according to [their] linguistic referents: e.g., the possibility of occurrence of several determinatives in succession in Egyptian hieroglyphics considerably increases the length of a block).

When hieroglyphic texts undivided into blocks are investigated, the accidental occurrence of polygrams can be considered as 'noise' (in the terminology of Information Theory) which is superimposed on linguistic communication encoded by means of the hieroglyphs. The elimination of some of the 'junctions' is possible by means of an analysis of the beginnings and endings of sentences.

In the Proto-Indian texts, thanks to the fact that we know the limits of the inscriptions, it is possible to set apart a considerable number of accidental polygrams. Thus, to these accidental polygrams belong the digram 87–232 (sign 87 is a frequent ending, whereas sign 232 is a frequent beginning of an inscription), and the combinations 66–232, 87–233, 124–233, 66–233, etc. The

[1] [Presumably digrams, i.e., blocks of two symbols, are meant.]

[2] [Cf. the previous paragraph regarding zero pentagrams or greater.]

TABLE 3

Polygrams of the hieroglyphic texts

		Types of Polygrams								
		2	3	4	5	6	7	8	9	Total
Egyptian Texts	Total	212	95	37	12	11	2	2	2	373
	in percentage to a text	25.1	18.0	9.2	3.9	4.1	0.9	1.0	1.1	63.3
	in relative frequencies	76	41	16	5	5	1	1	1	146
	Genuine	143	78	35	12	11	2	2	2	285
	in percentage to a text	17.3	14.2	8.7	3.9	4.1	0.9	1.0	1.1	51.2
	Errors	69	17	2	0	0	0	0	6	88
	in percentage to a text	7.8	3.8	0.5	0	0	0	0	0	12.1
	Referent-phoneme	17	0	0	0	0	0	0	0	17
	in percentage to a text	2.1	0	0	0	0	0	0	0	2.1
	Referent-morpheme	81	21	1	0	0	0	0	0	103
	in percentage to a text	9.9	4.0	0.3	0	0	0	0	0	14.2
	Referent-word	45	51	16	12	4	0	2	2	132
	in percentage to a text	5.3	9.1	4.0	3.9	1.5	0	1.0	1.1	25.9
	Referent-word-combination	0	6	18	0	7	2	0	0	33
	in percentage to a text	0	1.1	4.4	0	3.6	0.9	0	0	10.0
	Total	1246	558	164	19	6	4	0	0	1999
Proto-Indian Texts	Errors	408	160	48	8	4	0	0	0	626
	in relative frequency 89	101	39	23	4	2	0	0	0	168
	Genuine	840	398	116	11	2	4	0	0	1371
	in percentage to a text	26.7	19.0	7.3	0.8	0.2	0.4	0	0	54.4
	in relative frequencies	301	128	41	5	1	2	0	0	478

total number of such accidental combinations in the Proto-Indian texts is given in Table 3 and serves as additional characteristics of the relation between real and accidental polygrams, specifically when a set of short inscriptions is conditionally treated as a continuous text. About half of the total volume of Proto-Indian texts forms a part of the recurring polygrams (Table 3).

In many cases it is possible to divide into blocks even those parts of the inscriptions in which there are no recurring polygrams. This is achieved in two ways.

The first method consists of determining recurring polygrams within the limits of an inscription. That part of the inscription which is left outside these polygrams (if its structure does not exceed 3–4 signs) is treated as an independent block.

The second method of dividing into blocks those parts of the texts which were not included in the structure of recurrent polygrams is purely logical. In

the corpus of the Proto-Indian texts are inscriptions composed of one, two, three or more blocks where one and the same block is found in the structure of all of them, and some other blocks are also identical.

The comparison of such inscriptions enables us to point out a number of unique blocks. (Symbolically this procedure may be characterized in the following way: if there is a group of inscriptions of the structure a, b, axb, where a, b are recurring blocks, then x is considered to be a block even if it does not recur.)

4. THE MORPHOLOGICAL STRUCTURE OF HIEROGLYPHIC TEXTS

The entire set of polygrams of any hieroglyphic text can be divided into a few intersecting classes according to their composition. Signs substitutable in certain positions in the block-polygrams may be considered to be variable and semi-variable.[3]

The difference between variable and semi-variable signs consists of the order of their mutual sequence. The variable sign always 'gives way' to the semi-variable sign in a block-polygram and follows after (in the case of suffixation) or [precedes] before (in the case of prefixation) the semi-variable.

Thus, the semi-variable signs behave as if they 'pushed aside' the variable signs from the root-signs and polygrams.

Another fundamental difference between the variable and semi-variable signs is their distribution within a paradigm (more precisely within a micro-paradigm).[4]

Having a number of sign combinations: for instance, abx, aby, abkx, abky, abrx, abry (where ab is the root part, x and y the variables, k and r the semi-variable signs), we can see that the difference between variables and semi-variables consists not only in the fact that the semi-variable signs 'wedge' themselves in between the root part and the variables; but also in the fact that semi-variable signs are preserved within the limits of the entire micro-paradigm formed by variable signs, whereas the variable signs form the micro-paradigm whether or not the semi-variables are present.

Variable and semi-variable signs can occupy the initial or final position in a block, and they can also be inserted within a block. Apart from this, they can be combined with each other within the confines of a block immediately or across an interval forming a circumgraph [i.e., presumably an interrupted graph]. One or the other type of position of the variables and semi-variables in a block is characteristic of [respectively] one or another type of language in which the

[3] Yu. V. Knorozov, *Pis'mennost' Indejtsev Majja* (Moscow, Leningrad, 1963); *Predivaritel'noe soobshchenie o deshifrovke kidan'skogo pis'ma* [Preliminary Report on the Decipherment of the Kidan Script (Moscow, 1964.)]

[4] Cf. *Predvaritel'noe*, p. 48.

hieroglyphic texts are written. So, for example, for the language of the Kidan texts, the exclusive use of variable and semi-variable signs at the ends of the blocks is typical—a sequence characteristic of agglutination in the Turko-Mongolian family of languages.

In the ancient Egyptian hieroglyphics, the variable signs can occupy both initial and final positions. For instance, in the portion of "The Legend of Sinuhe" analysed as if it were an unknown text, the sign *n* occupies the final position in seven digrams and seven trigrams[5] as a marker of the past tense. Functioning as a preposition (as a marker of the objective case), the same sign occurs in initial position in seven digrams, one trigram, and three tetragrams.

The combinations of variable signs with root signs enable us to divide the root-signs into different morphological classes depending upon which variable (or class of variables) with which this or another sign, or combination of signs, forms a polygram.

Thus, in the analysed Egyptian text, the particle of negation *nn* is used in stable combinations only with verbs (e.g., *nn rh*, '[he] didn't know', *nn a' d̲m*, '[he] didn't hear').

This enables us to set apart a variable *nn*, and on the other hand, to refer to the verbs, other (non-recurrent) combinations before which this variable occurs.

5. THE MORPHOLOGICAL STRUCTURE OF THE PROTO-INDIAN LANGUAGE

The division of the Proto-Indian texts into blocks permits us to go on to discover the set of variable and semi-variable signs.

To the set of variable signs belong: 87, 124, 66, 501, 500, occurring in final position in 146, 48, 9, 22, 13 respectively, in various recurrent blocks. These same blocks are encountered without variable signs as well. Blocks with final signs 87, 124, 66 usually occur in final position in an inscription. Thus, ca. 30% of all inscriptions end with sign 87; about 7% with sign 124, and ca. 2% with sign 66.

As semi-variable signs we can consider 507, 83, 118, which occur in 10, 6, 3 respectively, in recurrent blocks. They occur either in final position (when

[5] These and all following markers are expressed not in absolute but in relative frequency, which means that what is given is not the general number of polygrams but the number of types of polygrams. For, the application of the methods of positional-statistics to the investigation of hieroglyphic texts undivided into blocks, requires a statistical description of their structure on the levels of the frequency of the emergence of new signs, of the absolute frequency of signs, and of the absolute frequency of polygrams; only then does it require the transition to relative frequency of polygrams conditionally equated with blocks, and to the determination of variable and semi-variable signs.

variables are absent), or in the penultimate position in the blocks (when variables are present).

With the aid of these variable and semi-variable signs, it is possible to divide the blocks into different classes, depending upon which variable or semi-variable signs occur in them. A similar division makes it possible to perform a morphological classification of blocks dividing them into 'the class of the variable 124', etc. Of especial interest are those blocks which belong to [several] different classes (e.g., 15–175).

A characteristic feature of the structure of Proto-Indian blocks is the conjunction of variable signs in pairs (e.g., 87–66, 124–66, 66–66). The conjunctions of variables 87–66 are encountered in twelve polygrams. The reverse combination 66–87 occurs only in the trigrams 196–66–87 and 80–66–87 (MI, no. 336).

The combination of variables 124–66 occurs in four polygrams (MI nos. 46, 479; 659, 664). The reverse combination 66–124 occurs in two polygrams (MII nos. 485; H. 11304). It should be noted that in one of these, the root-sign 80 occurs (the same as occurs in the trigrams 80–66–87); the semi-variable signs 118 and 507 only combine with the variable 87 (118–87; 507–87) or with each other (118–507).

6. SYNTACTIC RELATIONS

The combinations of variable signs with each other over definite intervals correspond to syntactic relations in the sentence. With the aid of computational techniques, the recurrent combination of signs divided by intervals (from 1–14 signs) were investigated. The results of the processing of the ancient Egyptian text (treated as unknown) proved that the characteristic syntactic relationships in sentences encoded in hieroglyphic script, can be discovered with the aid of interval statistics even if the given amount of textual material is minimal.

As long as the length of a text (i.e., a seal) varies within the limits of 1–8 signs (and in some cases more), it is more suitable to symbolize the syntactic relations of the Proto-Indian texts in the form of a table in which the initial variable and semi-variable signs are distributed along the vertical axis and the final signs along the horizontal axis. The Proto-Indian inscriptions not only have stable finals but stable initials in the texts. More than 10% of the inscriptions (Table 4) begin with the signs 232, 233, 126, 160.

7. THE LEXICON OF THE PROTO-INDIAN TEXTS

The analysis of the lexical composition of the Proto-Indian texts is fraught with specific difficulties involving primarily the scarcity of epigraphic material and the brevity of the inscriptions.

TABLE 4

Stable initials of the Proto-Indian texts in combination with stable finals

			Stable Finals in the Proto-Indian Texts							
			87	124	68	96	97	87—	66	Total
Stable Initials	232	501	52	16	6	12	3	4	1	94
	232	118	—	1	—	1	—	1	—	3
	233	500	3	—	—	—	1	1	—	5
	233	501	21	4	1	5	1	—	—	32
	99	507	8	2	—	—	—	—	—	10
	160	507	10	1	1	1	—	—	—	13
	160	118	1	—	—	1	—	—	—	2
	160	500	—	1	—	—	—	—	—	1
Total			102	28	8	20	5	6	2	171

The absolute frequency is given in the intersection of the graphs "stable initials" and "stable finals". Note that signs 232 and 126 (in Marshall's catalog) are given under one number 232, since they appear to be allographs.

Ca. 15% of the total volume of the texts is made up of variable signs (87, 124, 68, 66). Approximately the same percentage of the total quantity of textual material is covered by semi-variable signs. Hence, the variable and semi-variable signs make up about 1/3 of the total volume of textual material. It should be observed that in the Egyptian hieroglyphic texts also, approximately 1/3 of the total volume of textual materials was used to express grammatical markers (cf. Table 2, Graphs 4 and 5).

The other 2/3 of the total volume of the Proto-Indian texts is obviously made up of morphemic (root) signs, of phonetic signs, and of determinatives and numerals. The variable and semi-variable signs may also be employed as phonetic [sic] and as root-morphemes. The numerals comprise about 12% of the total volume of the texts. As a rule, the numerals are placed at the beginning of a block.

A considerable number of inscriptions are composed of a numeral (from one to ten) and the signs 96 and 97 (these two signs make up 3% of all the textual data and generally stand in final position in an inscription).

The low relative frequency of polygrams in which the signs 96 and 97 occur in final position (in spite of the high absolute frequency of these signs) does not enable us to consider them as variables in contradistinction to the signs 87, 124, 66, 68, also occurring as stable signs at the ends of inscriptions. The special combinations of signs 96 and 97 with various numerals force us to assume that they may be units of measurement (or special classificatory suffixes used with numbers).

Of special interest are the signs depicting fish (175, 178, 179, and others) which comprise ca. 10% of the total volume of the texts. The most frequent of them is 175, which stands in initial position in fifteen recurring digrams and in final position in twelve digrams. The classification of sign 175 as a variable sign is impeded by its comparatively low relative frequency and high absolute frequency; by its use with near-relative frequency in initial and final position and the combination of variable signs with blocks after sign 236 (e.g., 15–175–87, 15–175–124).

Curiously, sign 15 (comprising ca. 1% of the entire volume of texts but rare as far as its relative frequency is concerned) forms, along with sign 175, a stable combination occurring more than thirty times, whereas it never combines with other signs depicting fish. If one presupposes an accidental conjunction of the signs 15 and 175, the digram 15–175 should have been encountered about two times in the Proto-Indian texts.

We should note that, in the same fashion, the combination of sign 15 with sign 184 is not accidental: the digram 15–84 occurs in the texts more than twenty times. That digram would have been formed in the Proto-Indian texts approximately once in an accidental fashion.

8. CONCLUSION

The positional-statistical analysis of the Proto-Indian texts enables us to determine the system of the script; to point out different classes of signs; to determine stable combinations of signs (the polygrams); and, in most cases, to divide the inscriptions into blocks. The basic set of variable and semi-variable signs was established on the basis of the relative frequency of blocks and the position of signs in the blocks; and different morphological classes were established on the basis of combinations of significant signs with them [i.e., with the semi-variable and variable signs].

The combination of variable and semi-variable signs with each other (immediately and across an interval in several signs, right up to the end of the texts on a seal) allows us to determine the morphological and syntactical features of the Proto-Indian texts. What is characteristic of the Proto-Indian texts, as shown by the results of the positional-statistical analysis demonstrated above, is the suffixation and combination of two final variables. The results obtained enable us to make a comparison between the morphological and syntactic structure [on the one hand] with the structures of known languages and language families [on the other].

COMMENTARY

1. SUMMARY OF THE PAPER

A positional-statistical analysis was carried out on the Proto-Indian data and also on a control script – an unsegmented ancient Egyptian text, "The Legend of Sinuhe". As a further control, although the limits of the Proto-Indian stretches of symbols are known (i.e., the beginnings and endings of the inscriptions on a seal etc.) the Proto-Indian material was given a digital transcription for a continuous (not broken up into segments) text. This was done in order to enable the investigators to ascertain the curve of emergence of artificial conjunctions of signs or artificial "polygrams".

The curve of emergence of new signs in relation to the increase in length of the text in Proto-Indian inscriptions coincided with the curve of emergence of new signs in ancient Egyptian, forming sharp "overfalls" specific to hieroglyphic systems of writing.

The absolute frequencies of different signs in the Egyptian texts were computed and arranged in order of descending absolute frequency. High frequency signs in Egyptian were observed to coincide with those signs performing more than one function, i.e., expressing grammatical markers as well as representing a particular sound or sequence of sounds, whereas low frequency signs were either root morphemes or determinatives, or rare phonetic signs.

On analogy with the Egyptian data they considered signs of high frequency in the Proto-Indian data to function similarly – as grammatical markers, and those of low frequency to function as root morphemes. In order to divide the texts into blocks of signs presumably corresponding to words or roots, aside from the obviously recurrent polygrams, knowing the limits of the inscriptions helped them to determine blocks even in those parts of the inscriptions in which there were no recurring polygrams by determining recurring polygrams within the limits of the inscription and then treating that part of the inscription which was outside these known polygrams (providing their structure did not exceed 3–4 signs) as an independent block. Comparison of inscriptions composed of 1–3 or more blocks where one and the same block was found in the structure of all of them and several other blocks were identical, allowed them to identify several unique blocks (i.e., with inscriptions of the structure a, b, axb, where a, b are recurring blocks, x was considered to be a block regardless of its not appearing elsewhere). Stable, semi-variable, and variable sets of signs emerged, and different classes of blocks were established depending on which variables or semi-variables occurred with them. Some blocks belonged to several different classes.

In sum, Kondratov claimed that the positional-statistical analysis of the Proto-Indian texts allowed them to: (1) determine the system of the script;

(2) to point out different classes of signs; (3) to determine stable combinations of signs (the polygrams) and (4) to divide the inscriptions into blocks. The variable and semi-variable signs were established on the basis of the relative frequency of blocks and the position of signs in the blocks; the different morphological classes were established on the basis of the combinations of significant signs with the semi-variable and variable signs. Further, the combination of variables and semi-variables with each other (immediately adjacent and over an interval of several signs) is alleged to have allowed them to determine the morphological and syntactical features of the Proto-Indian data. Thus, the characteristics of the Proto-Indian language according to Kondratov consist of: (1) suffixation and, (2) combinations of two final variables.

2. DISCUSSION OF THE CONCLUSIONS AND METHODOLOGY

Reading Kondratov one becomes aware of a logical continuity of thought and deduction unparalleled elsewhere in this group of papers. This is at once admirable and disconcerting, for there is a dilemma which confronts the reader as regards the acceptability of certain rather basic premisses. Once these premisses have been accepted, however, (rather in the way one must accept Augustine's in the *City of God*) then all else follows, logically and conclusively.

Specifically, his very first assumption – and one which is never made explicit, or for that matter even realized by Kondratov as constituting a problem – is indeed open to discussion, if not actually shaky; are the positional-statistical methods Kondratov outlines sufficient to distinguish between system of script as opposed to system of language? Can one equate or match script and language as Kondratov attempts to do, even allowing for its logo-syllabic nature, and giving it the benefit of the doubt in regard to its provenance from the Indus Valley as a script specifically designed to fit the language of that civilization? Kondratov unfortunately, never comes to grips with the problem; in fact, he does not seem to be aware that there is such a problem and it never enters the discussion. To state it pernaps more succinctly – how does Kondratov distinguish at all between the system of the script and the system of the language it is assumed to represent? Are the conclusions reached regarding stable signs, variables, semi-variables, blocks of signs etc., in fact transferable to categories of language, or merely statements about the script? It is never made sufficiently clear that they are aware of this distinction nor that either the mathematics or the conclusions reached through the analysis are in fact relatable directly to the language of the script.

Do variables in fact necessarily match up with suffixes? If for instance, you wanted to indicate certain phonic characteristics such as glottalization for certain consonants (e.g., obstruents) and this glottalization only occurred

finally, if you used a sign | to indicate this and | alternated as a VARIABLE but in itself was neither logographic nor syllabic, would this not also constitute a phonic not a grammatical feature?; i.e., does | appear to be a suffix by Kondratov's analysis? Or if one used (as in Chinese) signs such as a cross † with phonetic indicator e.g., a hypothetical $\dagger_d$ vs. $\dagger_s$ where $\dagger_d$ signified 'dead' and $\dagger_s$ signified 'cross' how would this show up in Kondratov's analysis?

Kondratov does not even attempt to account for such possibilities since he bases all of what he says on the coincidence of the curve of emergence of new signs in Egyptian and Proto-Indian. Thus he brings us to question most strenuously what must be considered his second assumption: the matching or superimposing of statistics for one language onto another language presumably of an extremely different type.

The reader may accept the first assumption on the simple premise that no attempt whatsoever at the decipherment of the script can be possible without at least taking for granted that the design of the script somehow matches the language it is used for. In fact, script $\neq$ language, but as a working hypothesis one must assume certain things for convenience if one is to even attempt a decipherment on material of such a limited nature.

The second assumption is, however, not at all acceptable. The statistics for Egyptian hieroglyphics are just that – statistics for a Semito-Hamitic type of language, and can have essentially little or no bearing on the statistics associated with the Proto-Indian data. Further, a question related to such an assumption immediately jumps to mind: why was only one control used? If others were employed[1] and then rejected, Kondratov nowhere makes this clear, the bulk of the material in his paper in fact dealing with the Egyptian text and analysis even to the exclusion of certain Proto-Indian data where it would have been helpful.

In this connection also one should note the rather unfortunate terminology employed – namely, the use of the term "hieroglyphics". If the term is merely meant to convey the notion of a 'logo-syllabic' system of script it is perhaps understandable if not the best term; but, starting from the premise of similar "curves of emergence of new signs" in Egyptian and Proto-Indian, it is also a misleading term. Does Kondratov in fact wish to imply that the Proto-Indian writing is indeed not only logo-syllabic in nature but actually of the subtype which includes ancient Egyptian? If he does wish to equate the two writings in such a fashion, it again is something which is never made explicit; and further, is an extremely unlikely equation, considering the rather complex and somewhat unusual nature of the ancient Egyptian script. The reader must then take on faith much more than he ought to be required to do. If indeed Proto-Indian

[1] In fact, they do employ several others (e.g., Linear B, Rapanui "Te Kanaha", etc.) but these are only briefly noted in the paper by Probst.

is more like Egyptian than any of the other contemporary logo-syllabic scripts it would be worth noting and should have been made far more explicit; the inclusion of the Egyptian script ought to have been accompanied by the inclusion of other control scripts on an objective table indicating curves of emergence, e.g., Sumerian, Chinese, Linear B, Akkadian and other cuneiform scripts writings, and perhaps an alphabetic script as well for good measure.

Kondratov omits a step in his delineation of the procedures; he talks for most of his paper about the ancient Egyptian hieroglyphics, and then jumps to his conclusions about Proto-Indian without disclosing the criteria which were employed in setting up the variables and semi-variables.[2] The criteria must be extracted from Probst, and from the analogy by Kondratov of Proto-Indian with the Egyptian hieroglyphic system.

3. GENERAL

Kondratov's terminology leaves much to be desired. His equation of Proto-Indian writing with the statistical picture given by ancient Egyptian hieroglyphics is marred by the lack of objective data regarding other scripts used as control scripts and is not a particularly sound method in any case. Basing his entire equation of the types of scripts, etc., on the curves of emergence of new signs and consequent "overfalls" in Egyptian and Proto-Indian, he claims an hieroglyphic character for Proto-Indian. His data regarding the procedures for establishing the categories VARIABLE and SEMI-VARIABLE, and STABLE signs is never made explicit. And of major importance, the basis of his equation – i.e., the extent to which one may superimpose nature of language on nature of script is never dealt with. If one can accept the likelihood that the "curve of emergence", or the general statistical picture of variables in interplay with semi-variables and stable blocks is an accurate matching with affixes and roots in a given language, then his conclusions regarding the nature of the Proto-Indian language may be accepted; i.e., that the Proto-Indian script is charac-

[2] Kondratov asserts that the entire set of "polygrams" of any hieroglyphic text can be divided into a few intersecting classes according to their composition. Signs substituted in certain positions in the blocks (of polygrams) may be considered to be variable and semi-variable. Semi-variable signs take precedence over variable signs i.e., in their closeness to the root depending on whether they are prefixes or suffixes. Thus, "the semi-variable signs behave as if they 'pushed aside' the variable signs from the root-signs and polygrams. Semi-variable signs are preserved within the limits of the entire micro-paradigm formed by variable signs, whereas the variable signs form the micro-paradigm whether or not the semi-variables are present." Here one must ask what "within" is intended to signify – i.e., physically within?; if so, how could Kondratov explain inflections which are physically infixes; do variables always physically enclose semi-variables? This is never made clear.

teristically one of suffixes (rather than prefixes and infixes) and combinations of suffixes attached to a root, with modifiers preceding the word modified in all cases. In fact, this is difficult to accept without qualification and unfortunately it is one of the major obstacles to subscribing to his analysis since SCRIPT ≠ LANGUAGE. (The Egyptian language would look quite different, written in the Roman alphabet, but there is no doubt it could be written in this way, just as, similarly, English can be read in Devanagari – a syllabic script intended for the Indo-Aryan languages); and Egyptian (i.e., "Semitic") ≠ Proto-Indian (if it is Dravidian).

On analogy with the Egyptian system, signs with high frequency are considered to function as grammatical markers and those of low frequency to function as root morphemes. However, that the high frequency signs function as grammatical markers as well as having a phonic value is generally true of logo-syllabic forms of script – which, based on the number of signs, the Proto-Indian script can be adjudged to be; but the assumption that the low frequency signs must therefore be morphemic root signs, though possibly true, is a somewhat unsupportable conclusion; they could equally well represent sounds which correspond to no grammatical marker, or as Kondratov elsewhere notes in connection with the Egyptian signs, may be merely determinatives.

Kondratov asserts that the accidental polygrams (or conjunctions) become fewer as the number of segments in the polygrams increases – but this is said essentially of a Semitic type of language – Egyptian. Again, can one superimpose statistics of one language onto another?

Two major lacks in his tables are an *index a tergo* (a statistical assessment of the composition at the ends of blocks) and the effect of substitution of 'polygrams' and/or bound graphemes on longer sequences. These would have been of far more use in assessing the character of the Proto-Indian script than those tables which were included.

THE CHARACTERISTICS OF THE LANGUAGE OF THE PROTO-INDIAN INSCRIPTIONS

YU. V. KNOROZOV

1. Objects with inscriptions written in an unknown script were discovered during the excavation of the cities of the third to second millenium before our era, in the valley of the river Indus (Harappa, Mohenjo-daro, Chanhu-daro, Rupar), in the valley of the extinct, desiccated river Saraswati (Kalibangan), on the peninsula of Kathiawar (Lothal) and also in the ruins of the ancient cities of Sumer and Elam (Ur, Lagash, Kish, Susa).

In the overwhelming majority of cases, the inscriptions are incised in so-called seals; these were made of stone (usually steatite) and were of quadrangular, rectangular, or circular shape. As an exception, cylindrical seals of a Mesopotamian type are also encountered. The inscriptions on the seals are often accompanied by representations of animals, plants, and sometimes whole scenes. A few impressions of the seals on vessels and on clay plates were found, as well as inscriptions impressed on triangular clay amulets. In addition, there exist inscriptions on copper plates, on circular ebony sticks, vessels, various tools, and clay bangles.

2. Proto-Indian inscriptions are executed with horizontal strokes (on circular seals, ring-shaped strokes) from right to left (on the seals from the left to the right); with rare exceptions where the lines are written from left to right (on the seals from right to left).

More than 300 signs are comparatively weakly stylized, and in many cases one can discern a depicted object (people, animals, plants, buildings, etc.).

Among the signs, lines occur (from one to nine) which are undoubtedly numerals. Some of the signs are very similar to early Sumerian. The size of this publication does not allow us to deal with the historical study of the Proto-Indian script. There are usually from one to eight signs in an inscription, though episodically [sic] even longer lines are encountered. A considerable number of inscriptions exist in which identical components are found, and it is possible to follow the successive increase in the quantity of these components.

3. In an overwhelming majority of cases, the analysis of the inscriptions, with the help of interval statistics, enabled us to break the undivided text into

blocks corresponding to word-forms and stable word-combinations. One to five signs are found within a block, though tetragrams and pentagrams are quite rare. The signs may be classified as stable, variable, and semi-variable.

Stable signs are preserved in all cases, when the given block occurs, and obviously, they express root-morphemes. In the structure of a block one to two stable signs occur.

Semi-variable ('block-forming') signs may be divided into two sharply differing groups: the semi-variables of the first group occur before the stable ones; and the semi-variables of the second group occur after the stable ones but before the variables. Thus, they are retained within the limits of the entire micro-paradigm.

The variable ('block-altering') signs always occur after the stable signs and after the semi-variables of the second group. They can be interchanged with each other; they can be combined in pairs; they can disappear, forming a micro-paradigm; obviously, they perform the function of suffixes in the Proto-Indian language.

Within a block, zero to three semi-variable and variable signs are found. The division into stable, variable, and semi-variable signs is of a relative character and is relevant only within the limits of a given block.

One and the same sign can, in some blocks, appear as variable or semi-variable, but in other blocks it belongs to the stable signs.

4. To the first group of semi-variable signs (occurring before the stable signs) belong numerals which, obviously, denote numeral-substantives; some signs which do not occur among the stable signs and which obviously function as adjectives and those signs used as stable ones in independent blocks, clearly are to be considered as substantives. As semi-variables, they obviously must fulfill the function of adjectives.

The semi-variable signs of the first group correspond to determination in a Proto-Indian sentence and form blocks which obviously are to be considered stable word-combinations.

Thus, for example, the combinations of stable signs 175, 65, 183 with numbers 6(275–175) and 7(287–63), with the sign 15 which obviously [sic] has the meaning of a wide-spread adjective (15–175, 15–183), with the sign 135 (135–183), which is used in other instances as a stable sign. One should realize that the junction of semi-variable signs of the first group is possible without employing the variable signs.

The semi-variable signs of the second group (occurring after the stable ones) obviously have the function of word-forming suffixes. To these, one can attribute the signs 153c, 118, 91, 94. Thus, for instance, the junction of the sign 153c with the frequently occurring semi-variable sign 15 of the first group, transforms it into a stable sign; that is, it evidently substantivizes adjectives.

5. An inscription can consist of one ('basic') block either not having any variables at all (for instance, MII 153), or having final variables, -87, -87-66, -124-66, -66. When the inscription is longer, a preceding ('explanatory') block occurs which either has no variables (e.g., MI 13), or has final variables: -88 (a combination of the sign 87 with a small numeral one and also frequently, small numerals 1 and 2). Rather less frequently the 'explanatory' block occurs as a second (following) block, and in such a case it may not have any variables (for instance, 15-183-87 182, 21-87 182).

A sizeable group of inscriptions exists which contains specific numerals. The simplest type of such inscriptions contains the determined[1] sign (usually 96 and 97) and a preceding numeral which varies from three to nine, but frequently explanatory blocks also occur.

6. Notwithstanding the brevity and standard[ized] character of the inscriptions, it is possible to point out the following characteristic features of the Proto-Indian language: the word-order in a sentence is stable, the determination precedes the determined [element]; a substantive occurring before other substantives has the function of an adjective without the addition of any affixes. The combination of a numeral with a substantive does not require affixes of plurality. Only suffixes occur in the language (not a single prefix was registered). (Suffixes may be conjoined into pairs in definite combinations.)

7. Taking into account the antiquity and area of extent of the Proto-Indian culture, it is possible to assume that the Proto-Indian language belongs either to those languages [now] extinct or that it is akin to the languages of India (Indo-European, Dravidian, Munda), or to the languages of the Near East (Sumerian, Hurrian, Elamite). The problem of the kinship of the Proto-Indian language with one or an other linguistic family was solved through the following selections.

The affinity of the Proto-Indian language with Sumerian, Hurrian, and Elamite languages is impeded above all, by the position of the determiner, which in these languages occurs after the determined [element]. Apart from this, prefixes, which are characteristic of Sumerian, and the confluence of 'postpositions' and 'the transfer of determinatives' characteristic of Hurrian and Elamite, are not found in the Proto-Indian language.

Affinity with Indo-European languages (including Sanskrit and Hittite) is impeded primarily by the absence of prefixes in Proto-Indian.

Affinity with the Munda languages is impeded by the absence of prefixes in Proto-Indian, by the absence of infixes, and by absence of strongly-expressed agglutination which is characteristic of Munda.

8. There is reason to consider the Proto-Indian language as being close[ly related] to the Dravidian languages as far as grammatical structure is concerned.

[1] [I.e., "determined" by some determiner, e.g., an adjective.]

In Dravidian, as in Proto-Indian, determiner occurs before determinee. It is possible to combine two substantives, the first of which functions in the capacity of an adjective without the addition of affixes, and the combination of a numeral with the following substantive does not require plural affixes. In the Dravidian languages as in Proto-Indian, prefixes are absent and suffixes (case-endings) may be combined in pairs (forming new cases).

9. The variable –87 which has the record absolute and relative frequency can be compared only with the Dravidian suffix of the oblique case which also has the function of genitive suffix, and sometimes, of the locative, in Tamil *-attu*, in Telugu, *-ti*.[2]

One should note that sign 87 is a stylized depiction of the *aśvattha* tree (this is clear from its orthographic variants called *ati*, *atti* in the Dravidian languages).

The combination of the variables –87 –86 obviously corresponds to the Dravidian combination of suffixes: for instance, of the oblique and dative cases (Tamil *-attu-kku*).

The second suffix also occurs independently without the suffix of the oblique case.

The combination of variables –124–66 can correspond, for instance, to the Dravidian combination of the suffixes of the locative and dative forming a directional case in Tamil *-il-kku*, *-kan-kku*. It should be noted that the ancient Dravidian locative suffix *kan*[3] originally meant 'eye', and sign 124 has a shape similar to the Sumerian sign *igi* also signifying 'eye' (however, not used in Sumerian as a locative suffix).

10. Many Proto-Indian words and word-combinations, without doubt, became calqued into Sanskrit (and partially borrowed). [Sic !] This circumstance enables us, as an assumption, to determine the meaning of some Proto-Indian words; thus, for example, sign 96, depicting the hand usually occurring after alternating numerals, obviously corresponds to the Sanskrit *prasṛti*,[4] 'handful' (the basic unit of liquid measure). In that case the imprint on the vessel (made after firing) IV –96 signifies '4 handfuls', which corresponds to approximately a half liter in the traditional Indian system of measurements. Sign 183 depicts a female with elongated breasts and outstretched arms—a widespread symbol of the goddess of fertility since Neolithic times. In an overwhelming majority of cases, it is preceded by the semi-variable sign 15. A frequent epithet of the goddess of fertility is 'great'. The combination 15–183 obviously [sic]

[2] R. Caldwell, *A Comparative Grammar of the Dravidian Languages*, 3rd ed. (London, 1913) p. 183.

[3] [The correct transcription should be *kaṇ*; the etymology "locative" suffix *kaṇ*=*kaṇ* 'eye' 'is highly suspicious; rather, the locative suffix *kaṇ* should be etymologized as **k + aṇ*.]

[4] [The transcription in the Russian was *prasriti* which is incorrect.]

corresponds to the Sanskrit *mahādevī* (analogous names occur in Dravidian, too). Sign 15, which is extremely rare in terms of its relative frequency, also precedes sign 175, which is a depiction of a fish. The word-combination is evidently a Sanskritic calque *mahāmatsya*, 'great fish'. It should be noted that sign 15 is identical in shape to the Sumerian sign *gal*, 'great'.[5] In Sumerian, of course, this adjective always follows the substantive. In the Dravidian languages *min* not only signifies 'fish', but also 'star'.[6]

Hence, the stable combination VI-175 (incidentally the only stable combination with the number six) corresponds to the Dravidian *arumin*,[7] 'six stars' (the name of the Pleiades—one of the most revered constellations, playing an important role in the measurement of time). The use of the sign of the fish for the meaning of 'star' is possible only in the Dravidian languages.

Unfortunately, the extreme paucity of epigraphic material does not enable us to develop a detailed study of the grammar and lexicon of the Proto-Indian language. The majority of words occur in the inscriptions only once, and it seems impossible to establish their meanings according to the context.

COMMENTARY

1. SUMMARY

Using interval statistics, the Indus Valley texts were broken down into blocks corresponding to word-forms and word-combinations. One to five signs (usually one to three) – classifiable as stable, variable and semi-variable – were found to make up a block.

Stable signs were found to remain constant (with one to two within a block) and were presumed to express root-morphemes; semi-variables ("block-forming" signs) could be divided into two groups: those preceding stable signs, and those following the root, but preceding variables; (i.e., these are retained within the limits of the entire micro-paradigm).

Variable ("block-altering") signs always occur after the stable signs and after the semi-variables of the second type. Characteristically, variables are also interchangeable with each other, can be combined in pairs, and can "disappear" altogether. Knorozov equates the variables with suffixes. The division into stable, semi-variable and variable, however, Knorozov asserts, is of a relative character; identification of particular signs is only relevant within the limits of a given block.

5 MII, p. 454.

6 [An improbable etymological connection (cf. DED 3994 **min* and DED 3999 **mīn*), the connection based on an incidental similarity of the phonemic shape and on a wishful semantic connection: "star glitters–fish glitters".]

7 [This should be *cāṟu* + *mīn*.]

The first group of semi-variables is said to correspond to "determination" – i.e., numerals, signs which elsewhere in independent blocks are stable and are presumably substantives, functioning as adjectives in their semi-variable occurrences, and forming blocks which are to be considered stable word-combinations.

The second group of semi-variables is claimed to consist of word-forming suffixes.

Inscriptions thus are said to consist of: one ("basic") block either (a) having no variables at all (e.g., MII 153), (b) having final variables, or when the inscription is longer, (c) also having a preceding block which contains no variables or has final variables of a presumably limited type (e.g., the combination of sign 87 with a small numeral '1' or small numerals '1' and '2').

In general, the characteristic features of the Proto-Indian script are the following:

1. There is stable word-order in a sentence;
2. Determination precedes that which is determined (e.g., adjectives precede substantives);
3. Nouns occurring before other nouns function as adjectives and are without suffixes;
4. The combination of a numeral with a substantive does not require plural affixes;
5. Only suffixes occur (there are no prefixes or infixes);
6. Suffixes may be combined in pairs of definite combinations.

Thus, Proto-Indian according to Knorozov cannot be Indo-European, (or Munda) because of the absence of prefixes and infixes; cannot be Hurrian, Sumerian, or Elamite, because of the position of determination (i.e., modifiers). Knorozov argues for an affinity between the language of the Proto-Indian inscriptions and a Dravidian language on the basis of similarity of grammatical structure: in Dravidian, (a) determination precedes the determined element, (b) two substantives may be combined, with the first acting as modifier without the addition of affixes, (c) the absence of prefixes and infixes, whereas (d) suffixes may be combined in pairs (forming new cases). As an example Knorozov offers Ʊ (the variable –87) which has the highest absolute and relative frequencies and compares it to the suffix for the oblique case in Dravidian, which also has the functions of a genitive and locative (e.g., in Tamil or Telugu, *-ti*, *-attu)*.

Knorozov claims that sign 87 is a stylized depiction of the *aśvattha* tree and that therefore, this is a confirmation of its phonetic value *-ti*, or *-attu/i* since, it too is *ati* or *atti* in the Dravidian languages. Further, the combination of the variables –87–86 is a correspondence with the Dravidian combination of suffixes of the oblique and dative cases (e.g., Tamil *-attu-kku)*, where similarly the second suffix may occur independently of the first as well.

A further attempt is made to link sign –175 with the Dravidian **min* and **mīn*, claiming that it signifies not only 'fish' but 'star', and exemplifying its use in the combination which is said to correspond to Dravidian *arumīn* 'six-stars' or 'Pleiades'. Knorozov, however, gives no further examples and concludes that the paucity of material makes it impossible to adequately establish the meaning of words or to provide a detailed study of the grammar and lexicon of the Proto-Indian language.

2. COMMENTARY

Similar remarks may be made on Knorozov's paper as were made earlier regarding the paper by Kondratov. In general, the material is certainly thought-provoking, given that the assumptions on which the material is based are accepted (as perhaps they must be if one wishes even to attempt a decipherment of the script). The proposed analyses, conclusions, assumptions etc., in general are most convincing, given this acceptance of those basic premisses. The details, however, leave something to be desired in the way of accuracy, rigorous documentation, and particularly, thoroughness.

One must object, for instance, to the act of faith implicit in accepting the notions of "stable", "semi-variable" and "variable"; he presumably bases these classifications on actual evidence; the evidence, however, is never made explicit and in one instance is highly suspect. (If identification of particular signs is only relevant within the limits of a given block, on what basis is the reader to accept the classification at all?)

Similarly, though for the most part what is said regarding the impediments to considering Munda as a possibility for the language of the Proto-Indian inscriptions can be considered correct, the supposed "strongly-expressed agglutination" of Munda is fallacious since Dravidian is, if anything, more, rather than less agglutinative than Munda. The only strong case against Munda is the absence of both prefixation and infixation in the script. All else said regarding evidence favouring a Dravidian hypothesis can be adduced for Munda as well. Furthermore, no mention is made of the Altaic languages which fit the typological characterization equally as well as does Dravidian.

Other details, noted for the most part in the body of the text, are those of documentation, accuracy of reconstruction etc., such as the equation *min* = *mīn*.

In general, one would have wished the authors had seen fit to include specific tables of signs including their absolute and relative frequencies; and in particular, grids of a sort that one finds in the decipherments of Linear B and Hieroglyphic Hittite. Much more could have been done in the way of preparatory grids both in terms of the inner workings of the script and in terms of the

possible alignments of particular signs with specific linguistic units. The assumption that only a Dravidian language is possible as the language underlying the script is certainly untenable until such preliminary attempts to align elements of the script with specific reconstructed linguistic units has been tried. The attempt to "read" concrete phonemic shapes of Dravidian or Proto-Dravidian morphemes into the signs, at the stage at which the authors find themselves, is to say the least, premature.

Furthermore, one would have liked to see a full discussion of the problems involved in relating the statistical analyses of the signs with the system of the language presumed to underlie the script, showing in detail the methods used to arrive at the equations or matching of sign classifications with language categories. Though the reviewers of course, acknowledge the great difficulty in attempting to decipher such a script and the reasons therefore for such equations, we feel it would have been more befitting a scholarly publication had the authors been somewhat less bold in their assertions as to the correctness of what must, at such an early stage, only remain hypotheses.

ON THE QUESTION OF THE LINGUISTIC AFFINITY OF THE PROTO-INDIAN LANGUAGE

I. K. FEDOROVA

The study of Proto-Indian inscriptions enabled us to point out some characteristic features of the Proto-Indian language. This allowed us to raise the question of its affinity to the languages of India and the Near East. In the present short paper only the data about the little-known Munda and Dravidian languages are considered in any detail.[1] For the language of the Sumerians, the characteristic feature is the strictly fixed word-order with determination [i.e., qualifiers] after the determined word. The object occurs before the predicative verb. Suffixes as well as prefixes occur in the Sumerian language. Case endings are expressed by independent markers (postpositions) which occur at the end of the entire syntagma.

In Hurrian and Elamite the determination [or qualifier] occurs after the determined word. In these languages only suffixes occur, and they are added in agglutinative order. Besides this, a characteristic feature of the Hurrian language is the 'transfer of determinants' (a phenomenon which is absent in Proto-Indian); the final marker (or markers) of the grammatical relations of a word recurs as a qualifier of [each of] the other [accompanying] words which modify it. 'Transfer of determinance', though different from that in Hurrian, is also characteristic of the Elamite language. (In this language determinants of definitiveness and number are transferred.)[2] The literary language of ancient India—Sanskrit—is different from the Proto-Indian language in a number of features. For Sanskrit, free word-order is characteristic; [and] along with highly developed suffixation, there are a great number of prefixes in Sanskrit.

The early Neolithic settlements (having a characteristic microlithic industry) of people speaking languages which subsequently became known under the designation of the Munda family, were discovered in the upper reaches of the

[1] [Little-known Dravidian languages?! K. Z.]

[2] I. M. D'jakonov, "O Jazykax drevnej Perednej Azü", *Voprosy Jazykoznanija*, No. 5 (1954).

Indus (close to Peshawar) in the valleys of the Indus and also throughout the whole of Hindostan.[3]

Rigid word-order is typical of the Munda languages:[4] subject-predicate; object-predicate; subject-object-predicate. In several instances, the subject occurs at the end of the sentence, e.g.,

Adâ chabayen-a[5] *katha-dâ*
'So finished-is the tale'[6]

The adverbial modifier occurs either at the beginning of a sentence or before the predicate. The object usually stands before the predicative verb but can also be placed before the subject. In all Munda languages determination (expressed by a substantive, adjective, numeral, or pronoun) occurs before that which is determined. The numeral, when used with a substantive, requires the plural affix, e.g.,

barah bahin-kû dohon-en-ā
'Twelve sisters were'[7]

The substantive or pronoun used as attribute has a genitive suffix.

Ale hatu-reyak' mit' ha aiñak ote erer-ked-a[8]
'Our village-of one man my land took-possession-of'[9]

In Santali the genitive case is formed by the suffixes *-rān, -ak', aṅ, rēak, -reaṅ* (e.g., *ōrak' -rān kisar*, 'of the house, lord'). These suffixes or their variants are used in other languages of the Munda family.

In the Munda languages, affixes of various kinds are used. For instance, in Santali, there are prefixes, suffixes, and infixes; and the prefixes—and especially infixes—play a substantially greater part than the suffixes.

In the Dravidian languages the following word-order is usually found: subject-action; subject-object-action; object-subject-action, e.g.,

Hinagu thōḍi nāḷ hōsa
'so a few days passed'[10]

[3] D.H. Gordon, *The Prehistoric Background of Indian Culture* (Bombay, 1958), p. 38, Figure 3. [This identification of Neolithic settlement with prehistoric Munda-speaking peoples is highly doubtful.]
[4] [See commentary.]
[5] [The original has *chaba-y-en-a.*]
[6] Santali, G. A. Grierson, *Linguistic Survey of India*, Vol. IV (Calcutta, 1906) p. 61.
[7] Korwa, *Ibid.* p. 165.
[8] [See commentary.]
[9] Ho, *Ibid.* p. 124.
[10] Brahui, *Ibid.* p. 633.

A garrālu ā billani batakapise
'these horses these boys saved'[11]

Paragoṇḍu avaḷ-ē aṅgē ambaḷa mavunna kadi-buguda
'Afterwards she-indeed this male child bore'[12]

Echarchakā ēṭitun brukāl hurtu
'Then the goat-to the tiger saw'[13]

The position of the adverbial modifier in the Dravidian languages is identical with the position of the adverbial modifier in Munda.

The object in Dravidian occurs as a rule between subject and predicate, but it is also encountered before the object. Such cases are characteristic of ancient legends, e.g.,

A nāllayā khudryāṅg aun metstsun patu
'These good horses their brother-in-law saw'[14]

ta jānvartun pullī tind
'these animals the tiger ate'[15]

maṅg khēṛata jānvar pullī vaïyūnd
'[and] the wood of animals the tiger to king away-was'[16]

Determination in the Dravidian languages occurs before the determined word. The combination adjective-substantive may be joined by determination, expressed by a substantive, numeral, or pronoun. Examples:

Varu chellulu ūri-ki pāyiri
'They sister-of village-to went'[17]

Vaṇḍ ūrāpō raṇḍ ghwaṇṭang niḍisū
'by one person two sisters were'[18]

In the Dravidian languages, the substantive—in the function of determination—may occur, without any affix, before the determined word. Otherwise, a substantive used as determination may have the suffix of the oblique case.

[11] Telugu, Grierson, *Linguistic Survey of India* vol. IV, p. 614.
[12] Tamil, *Ibid*, p. 328.
[13] Gondi, *Ibid*. p. 526.
[14] Tamil, *Ibid*. p. 339.
[15] Gondi, *Ibid*. p. 521.
[16] Gondi, *Ibid*. p. 521.
[17] Telugu, *Ibid*. p. 613.
[18] Burgaṇḍī, *Ibid*. p. 345.

Suffixed word-formation and word-inflection are characteristic of the Dravidian languages. For instance, in Tamil, no formative elements exist which would occur before the root.

In the investigation of the grammatical features of the Proto-Indian language and especially the position of the determination before the determined word, the absence of prefixes and infixes, the combination of suffixes and other features make it possible to relate the Proto-Indian language to Dravidian. On the other hand, the analysis demonstrates that it is impossible to relate it convincingly to the other languages of Hindostan [sic] and the Near East.

COMMENTARY

1. MUNDA

Without a doubt this is the worst paper of the lot. It would appear Madame Fedorova's linguistic preparation was not adequate to the task set her. Throughout the paper there are gross discrepancies, evidences of sloppy scholarship, and indications of a general lack of grasp of various problems, to say nothing of the languages. It is clear from the start that she is unfamiliar with either Munda or Dravidian and her sweeping generalizations are clear testimony of this.

Her first blunder is her blithe statement that "early Neolithic settlements (with a characteristic microlithic industry) of peoples speaking languages which subsequently became known under the designation of the Munda family, were discovered in the upper reaches of the Indus, in the valleys of the Indus" and so on; this blunder is however compounded into a felony when she attributes this erroneous information to D. H. Gordon, *The Prehistoric Background of Indian Culture* (Bombay, 1958) p. 38 [sic], figure 3.

First of all this is simply wrong. There do exist widespread Neolithic settlements in India and in the Indus area, but nowhere does Gordon (or anyone else to our knowledge) equate the highly varied and apparently unrelated Neolithic (and microlithic) settlements of all the areas to each other; and what is even more essential, nowhere is it suggested that the Mundas are somehow connected with these diverse settlements. Second, the most that could be inferred from what Gordon says (and on page 35 not 38) is that these settlements reflect aboriginal peoples whose language PERHAPS[1] survives in the Munda or Kol speech; "but they are by no means of one exact physical type" and "they are merely evidence of a basic pre-Aryan and pre-Dravidian people(s)".

Basing her decision that Munda could not be the Proto-Indian language on three examples – and those examples from a subgroup (Kherwarian) of a

[1] [Small capitals are the reviewers'.]

branch (North Munda) of the Munda language family – she demonstrates a lack of linguistic sophistication, careful scholarship and general awareness of the problems involved. She certainly knows no Munda. First she claims a rigid word-order for Munda; this is simply untrue, almost any order may occur. Using Grierson – certainly not the most extensive or up-to-date source for the Munda languages in any case – she draws her three examples, inaccurately analysed and misunderstood, from Kherwarian which is certainly questionably representative of what must be presumably reconstructed for Proto-Munda. (It is not out of the question that even at that early date there could have been great diversity between North and South Munda, but Fedorova does not even raise the question, or note its pertinence to the discussion.) Certainly it is a highly questionable procedure to pass judgement on whether a language group could have a particular structure when one really can have no – even approximate – idea of the syntactic features of the language-group, or of a particular – hypothetical – language at that time. Mme. Fedorova does not seem to be even aware of the problem. She does not go beyond the most accessible – sketchy and highly incomplete – sources on which to base her opinions. Further, even these meagre sources are incompletely analysed, as a reading of Bodding would have demonstrated. The standard order in North Munda is Subject-Object-Predicate, but word order is NOT rigid. It is also true that much of the syntax is borrowed from Indo-Aryan in a number of areas, including such word order features as a particular Object-Verb-Subject (derived) order which has a particular intonation pattern. This further testifies to its being a borrowed feature. Adverbial modifiers do precede the words modified, but this is as true of Hindi as it is of Munda, and so is hardly to be taken as a reflection necessarily of the earlier pattern. It is not at all out of the question that it is in fact borrowed from Hindi.

Fedorova contradicts herself several times in the very examples she offers to the reader. For example, she says: "in all Munda languages the determination ... occurs before that which is determined. The numeral, when used with a substantive requires the plural affix." But she offers as an example, *barah bahin-kū dohon-en-ā* which (the original having *bārah* for 'twelve') does not at all support her contention, for one would expect then **bārah-kū bahin-kū* . . . What she obviously had in mind is the sentence in Grierson which followed the example she gave:[2]

Tō	*bārh-ō*	*bahin*	*akū*	*salah-nen-ā* . . .
Then	twelve-the	sisters	they	agreed

Apparently not only did Fedorova not know much if any Munda but, she was unable to use adequately even those sources available to her. As for the genitive suffix, she gives the example:

[2] Korwa, *Ibid*. p. 165.

Ale	*hatu-reyak'*	*mit'*	*ha*	*aiñak*	*ote*	*erer-ked-a*
Our	village-of	one	man	my	land	took-possession-of

(misquoted for *ale hatu-reyak' mit' ho aiñak ote eser-ked-a)* asserting that the substantive or pronoun used as attribute has a genitive suffix, but offers no explanation for the apparently contradictory form *ale* 'our'. There is no obvious suffix *-ak'* in *ale;* she could perhaps justify the loss of *-ak'* as some kind of sandhi (or morphophonemic reduction) but she is not even aware of the problem or its possible solution.[3]

With reference to the supposedly greater role played by prefixes and infixes as opposed to suffixes, again this is pure fiction on Fedorova's part. It is certainly not true of North Munda verb constructions, and not shown by the two examples in her text – which have not been fully analysed. These examples do not support this contention since they each contain three suffixes and NO prefixes or infixes, i.e., *dohon-en-ā* should be analysed as *doho-n-en-a* at least (there are possibly even further morpheme breaks) and for *erer-ked-a* (misquoted *eser-ked-a)* there should have been the analysis *eser-ke-d-a*. It is certainly true that there are prefixes in the Munda languages, but for the verbs, primarily in a few languages of South Munda, not in North Munda from which she draws all her examples. In any case, they do not play "a substantially greater part than the suffixes" in any of the Munda languages.[4]

A. R. K. Z.

2. DRAVIDIAN

A general remark first.

From the point of view of strict historical and comparative linguistic method, there is NOT THE SLIGHTEST PROOF of the genetic relationship of Dravidian and the 'Harappan' language. All the various data quoted in the different papers in both monographs, belong – from the point of view of strict comparative and historical linguistics – to the realm of sheer speculation. This does not mean that *a priori* such genetic kinship is ruled out. On the contrary, *a priori,* and purely speculatively, a genetic relationship between Dravidian and the language(s) spoken in the Proto-Indian area, seems rather likely. But this aprioristic speculation cannot be either proved or disproved at present.

[3] In fact in Korku morphophonemics, when the genitive suffix-àʔ follows a noun or pronoun ending in a vowel (and this does not precede a pause), what remains is merely low tone on the final vowel of the noun: e.g., the Korku genitive of a non-pre-pausal *ale* would be *alè*. (Korku example courtesy of Norman Zide.)

[4] Verbal prefixation is presumably archaic and survives in Gorum for example, a Koraput Munda (South Munda subgroup) language in forms such as *ne-laʔa-t-om* 'I- beat'-fut. -'thee' ('I shall beat thee').

On the other hand, the TYPOLOGICAL AFFINITY between Dravidian and the 'Proto-Indian language' seems to be established once we accept as valid the results of the positional interval statistics and other computerised investigations carried out by Knorozov's team. This high probability of a typological affinity between Dravidian and 'Proto-Indian' may be arrived at, however, quite independently by the reader without taking into account the very poor paper by Fedorova.

The following detailed remarks may be made:

1. It is impossible today, and it was impossible in 1965, to speak about Dravidian languages as "little-known". (Cf. what M. B. Emeneau has to say about the present state of Dravidian studies: "Dravidian linguistic studies flourish in this mid-century period. It can be said now, as it could not in the 30's, that this is a field in which all the world is engaged – Dravidian India, Ceylon, and Malaysia most numerously, but also the United States, Europe, including Great Britain, France, the Netherlands, Germany, Austria, Czechoslovakia, and Russia, and even Japan. Detailed work, descriptive and comparative, old-style and transformational-generative, core studies and sociolinguistics, is written and published, in a surprising number of journal articles and books. The picture of this activity is sketched in the pertinent chapters of the forthcoming volume 5 of *Current Trends in Linguistics*, which at the current rate of activity in the field, will be out-of-date before it appears"[5].) To talk of the Dravidian languages as "little-known" in 1965 is, to say the least, grotesque. Unfortunately, however, Mme. Fedorova seems to have gained her knowledge of the state of affairs in Dravidian from sources published fifty years ago, and only from these sources. This is one of the very serious drawbacks of her short paper: she has gotten her very meagre data from Grierson's *Linguistic Survey of India*, Volume IV, which is dated 1906 – and uses them in 1965, in spite of all the work done by Burrow, Emeneau, Bloch, L. V. Ramaswami Aiyar, *et al.*

2. The selection of Dravidian examples could hardly have been more unfortunate. Fedorova has lumped together in pell-mell fashion a few instances giving wrong designations of the languages and quoting without any precision whatsoever. One should point out her mistakes and her lack of rigor step by step.

Her first example is proof that Fedorova knows hardly any Dravidian: She boldly assures us that the utterance *hinaga thōḍi nāḷ hōsa* (misquoted in any case for *hināga thōdē nāl hōsa)* is Brahui, taken from Grierson, *L. S. I.* Vol. IV p. 633. It is of course not Brahui at all, it CANNOT be Brahui with forms like *nāḷ* 'day' or *hōsa* 'passed'. It took the reviewer some detective work to discover that this is a misplaced specimen of Korava, Grierson, *L. S. I.* Vol. IV, p. 326!

[5] M. B. Emeneau, "Dravidian and Indo-Aryan; The Indian Linguistic Area", mimeographed (Austin, 1968).

Her second example is inexact: it should be *ā gurrālu a biḷḷani batakapise* (three misquotes in a stretch of five items!)

Her third example, said to be Tamil, is actually taken from the highly divergent Korava dialect (of Tamil?), which will very probably prove not to be Tamil at all. Here, too, the form *kadi-buguda* is misquoted for *kaḍi-bugudā*.

Her fourth example contains no misquotations.

Her fifth example is again not Tamil, but Kaikādī which probably will prove not to be Tamil at all. Moreover, instead of *meṭṣ̱tsun* she has *metstsun*, and instead of *pātu* she has *patu*.

Her sixth example is almost correct (instead of *tā* she has *ta*, but, after all, what is an omitted vowel length). In her seventh example, also from Gondi, she misses two vowel length markings: instead of *khēṛātā* she has *khēṛata*. This time, she also forgot to translate into Russian the Go. *mang*, English *'and'*.

The eighth example is all wrong: the correct version is *vāru chellelu ūri-ki pōyiri* (again, three misquotes in four items).

Finally, the ninth instance: only two mistakes (sisters for sons and *niḍisū* for *niḍisū*). But what strange logic this time induced Fedorova to say that this instance is taken from the "Burgaṇḍī language"? Burgaṇḍī is classified by S. Konow in Grierson *(L. S. I.* Vol. IV) as a TAMIL DIALECT, just as Korava and Kaikādī. There, Fedorova raised Burgaṇḍī to the level of an independent language, while in the other cases she denied Korava and Kaikādī the status of dialects, and just called them Tamil.

3. What she has to say about the structural properties of Dravidian is generally right. She has however dealt only with the most general features of Dravidian structure, and even with these features rather nebulously. The strongly worded verdict *(perebor pokazyvaet nevozmozhnost' ubeditel'nogo sblizhenija* etc.)[6] is based on three Munda and nine Dravidian examples(!) chosen in helter-skelter fashion, and misquoted. Fedorova's paper discredits the whole work of the team and has some features which unfortunately, are typical of the whole monograph (lack of rigor, lack of documentation, sweeping generalizations and arrogance of tone).

K. Z.

3. SUMMATION

Fedorova's treatment of both the Munda and the Dravidian languages is based on scanty, out-of-date materials and reflects a general ignorance of both language families, and the linguistic problems involved in trying to assess the likelihood of a language from either group being the language of the Proto-Indian writings.

[6] ('The analysis shows the IMPOSSIBILITY of a CONVINCING correlation ...' etc.).

Her argumentation starts from preconceived notions, and a desire to match Proto-Dravidian with the language of the Proto-Indian script (however possible or plausible this may be) and is not based on sound linguistic procedures or familiarity with the languages in question. Her scholarship is most careless, and highly suspect. Instead of deducing the relationship from reliable linguistic facts and sound procedures, she brings her preconceptions to the problem and attempts to make the 'facts' fit the preconceptions. Indeed they may, but Fedorova is not the linguist she needs to be to demonstrate this. In general her methods lack rigor, documentation, and are riddled with sweeping generalizations and arrogance of tone. A wholly unsatisfactory paper.

IMAGES ON OBJECTS WITH PROTO-INDIAN INSCRIPTIONS

B. YA. VOLČOK

1. The Proto-Indian inscriptions are often accompanied by representations of emblems, plants, animals, and various scenes. The most frequently occurring emblem is the swastika (widely used in later Indian symbolism) and the lattice (which is a part of the so-called 'standard' which is often encountered). As far as plants are concerned, only the image of the *aśvattha* or, apart from that, the palm tree is encountered.

Especially frequent are isolated images of aurochs (standing in front of the 'standard'), less often of a bull, buffalo, elephant, rhinoceros, tiger, gavial with a fish between its jaws, antelope with the head turned back, or a buck. It is striking that some animals characteristic of ancient India do not occur: for example, the lion (which is widespread in later Indian heraldics). Thus, even in the Proto-Indian variant of the Mesopotamian hero Gilgamesh holding apart two lions, those animals are replaced by tigers (MII 75, 86, 122, 454).

2. Apart from realistic images, one comes across the anthropo-tri-saur[1] (the bull with a human face, an elephant's trunk, and a tiger's tail), a tigress with zebu's horns, tricephalic aurochs (with the upper head of an antelope, the lower head of a bull), tricephalic rhinoceros (with the upper head of an aurochs (?), the lower head of a bull), a dicephalic [animal] (with the body of a rhinoceros and heads of an antelope in [both] front and back), an ecto-saur (a star-shaped figure with the heads of an aurochs, buffalo (?), tiger, zebu, and bull; a variant of this figure occurs with the single head of an aurochs).

On a number of amulets, polytheria are depicted—groups of animals usually following each other in succession: the tiger, buffalo (?), rhinoceros, elephant, gavial with a fish, bird (trihedral amulet MI CXVI, 14; CXVIII, 10a); buffalo, bull, aurochs, tiger (?), gavial with fish, bird (trihedral amulet MI CXVI, 14;

[1] [The Russian is *zavr*; there is no commonly occurring equivalent and the etymology is not a good one since the Greek σαυρος (Russian *zavr)* means 'lizard'.]

CXVIII, 10a); aurochs, elephant, rhinoceros, gavial with fish, bird (trihedral amulet DXC, 13b);[2] tiger, elephant, aurochs, bull, scorpion (?), (MII, XCI, 13; 19a; XCII, 2, 10; CIII; 16; MI, 376, fragment); elephant, tiger, rhinoceros, buffalo (MII, no. 420); gavial, three fish, tortoise (trihedral amulet MII CI, 2–3).

4. The scenes occur mainly on amulets and rarely on seals: various persons, animals, and objects are depicted in them [i.e., the scenes]. Single scenes, isolated images, and emblems sometimes combine on identical or on different sides of one amulet. Separate scenes are combined in series so that identical characters figure in them (the tigress, buffalo, an enthroned god, a goddess in a tree). These series of scenes are obviously a kind of mythological abstraction.

5. The tree which is most often depicted on the seals and amulets is identified as *ficus religiosa* (Sanskrit *aśvattha*, 'place for horses'; pipal). The characteristic feature of an *aśvattha* tree is a specific arrangement of branches growing in all directions (most characteristic are the lower branches hanging down) and the heart-shaped leaves with strongly elongated sharp points and with clearly visible veins.

On seal MI no. 387, the *aśvattha* is depicted with four side-branches from each of which a smaller branch diverges. Lower on the trunk two hanging boughs branch off. Above the roots a circle with eight concentrically placed dots is depicted; the dots encircle the central [dot]; from the circle are drawn two aurochs' heads on long necks. On the impression of a seal (Ch. no. 36), two human figures are depicted under an *aśvattha* tree, with four branches, holding its trunk.

In a number of instances, an *aśvattha* tree is depicted with two trunks, between which stands a female personage (e. g. MII, no 430.)

In these cases, sometimes the representation the *aśvattha* is stylized, taking the shape of an arch. (e.g., H. 13, 14, 19). Obviously the *aśvattha* (a palm according to Gadd)[3] is depicted in the scene on the Proto-Indian cylinder seal found in a burial structure of the king *Bur-sin* (the city of Ur). Apart from this, the *aśvattha* and its leaves are frequently depicted on Proto-Indian ceramics.

6. In the literary monuments of the Vedic period, the *aśvattha* is a tree of the universe under which the gods sit in the third highest heaven. In the Vedas, particularly the *Atharva-veda*, it is mentioned as a tree under which gods assemble in heaven (the later term [is] *devā-sadana-aśvattha)*. In the *Bhagavad-gītā*, the *aśvattha* figures as a tree of the universe.[4]

The *aśvattha* is considered to be the abode of the gods of the Hindu trinity,

[2] [Should probably be XC, 13b.]

[3] C. J. Gadd, "Seals of Ancient Indian Style Found at Ur", *Proceedings of the British Academy* (1932) p. 196.

[4] M. Monier-Williams, *Indian Wisdom* (London, 1876) p. 432.

and also of the spirit of the dead; it is looked upon as a tree of the female sex and in the ceremony of the marriage of trees, it frequently plays the role of the wife of the banyan.

The hypothesis of M. Williams that the *aśvattha* functions in the role of the husband of the banyan[5] is obviously erroneous and one of the instances of a frequent confusion of the *aśvattha* with the banyan, which probably can be explained by the intergrowth of those two trees—usually the *aśvattha* and the banyan closely intertwine—and also by their botanic affiliation.

The confusion of the *aśvattha* and the banyan frequently occurs in literature as well as in the arts. This is reflected in mythology as well, and both the *aśvattha* and the banyan are considered by Hindus as sacred trees of Vishnu. It should be noted that the Buddhist *bodhi* tree is always depicted in the arts as an *aśvattha* in spite of the fact that it is well-known that the tree itself in Bodhgaya (near Patna)—the remnants of which are still preserved—under which, according to Buddhist legends, Buddha attained enlightenment—is, in fact, a banyan.

The *aśvattha* tree has been a sacred tree in India right up to present times, and it is considered to be the place where the god dwells. It is thought that its branches contain magical power, namely, to repel evil spirits, and its leaves help fulfill various wishes (for wealth, male progeny, etc.). The *aśvattha* is also considered a dangerous tree. It should not grow in the vicinity of a house, and people should not touch it; women should circumambulate it several times a day. The ceremony of worshipping the *aśvattha* takes place every Thursday in the month of *śravan* (July–August).

The *aśvattha* is considered to be the sacred tree of the planet Jupiter and hence, of the fourth day of the week, Thursday; the traditional symbol for Jupiter and Thursday is a lotus-shaped leaf.

The *aśvattha* as the tree of the universe is the tree of knowledge, or the 'wishing-tree' *(kalpataru, kalpavṛkṣa)*, and as such it is frequently depicted in the arts. The most frequent type of *aśvattha* image as the 'wishing-tree' is one central branch with two side-branches;[6] the central branch and four side-branches growing out of the root.[7] When the *aśvattha* is described in literature, it is always described as having four or five and never two or three branches.[8]

The circle with eight concentric dots is pictured in Hindu iconography as on the body of *devī*, the *śakti* of *Śiva*.[9]

[5] Monier-Willams, *Wisdom*, p. 42.

[6] F. D. K. Bosch, *The Golden Germ. An Introduction to Indian Symbolism* (The Hague, 1960) Table 22b.

[7] *Ibid.* Table 23b.

[8] *Ibid.* Table 76.

[9] E. Moore, *The Hindu Pantheon* (London, 1810), Table 38.

7. According to Buddhist and Hindu cosmographic notions, four main and four secondary directions were distinguished apart from the zenith and the nadir. The four side-branches in the image of the *aśvattha* obviously correspond to the four cardinal points, the central branch to the zenith, the root to the nadir. The four side-branches in the image of the *aśvattha* (MI, no. 387) obviously correspond to the secondary directions.

8. The Hindu tradition identifying the four primary and four secondary directions with certain gods is most clearly reflected in the *Purāṇas*. According to this tradition, eight gods of the Hindu pantheon form a special group of gods called *loka-pāla* ('the guardians of the world'). The gods of the directions are as follows:

East – the god of the lower heaven, *Indra; vāhana* (Sanskrit for 'vehicle'), the elephant;

Southeast – the god of fire, *Agni; vāhana*, the ram;

South – the god of death, *Yama; vāhana*, the buffalo;

Southwest – *Nirṛti* ('misery'), (sometimes *Sūrya*, 'the sun'); *vāhana*, the horse;

West – the god of the firmament and water element, *Varuṇa; vāhana*, the mythical *makara*, 'the fish';

Northwest – the wind-god, *Vāyu* (sometimes called *Marut, Pavan*);[10] *vāhana*, the deer;

North – the god of wealth, *Kubera;*

Northeast – *Īśāna* (one of the names of the gods of tempests and hurricanes, *Rudra*); *vāhana*, the bull.

9. The idea of the identification of the gods with the directions was especially developed in Buddhism which distinguishes between several groups of gods as symbols of world directions.

The group of gods called *dik-pāla* ('the guardians of terrestrial directions') reflects exactly the above-mentioned '*loka-pāla*' of the Hindu pantheon.

East – *Indra; vāhana* – the elephant;
South – *Yama; vāhana* – the buffalo;
West – *Varuṇa; vāhana* – the crocodile;
North – *Kubera; vāhana* – man;
Northeast – *Īśāna; vāhana* – the bull;
Southeast – *Agni; vāhana* – the ram;
Southwest – *Nirṛti; vāhana* – man;
Northwest – *Vāyu; vāhana* – the deer.

In Buddhism, one of the forms of the god *Mahākāla*, the *Mahādevī* of *Śiva*, is connected with the directions of the earth.

10 [Should be *Pavana*.]

In the *sādana* (the Buddhist literary monument containing the instructions for the worship of the Buddhist gods), it is maintained that *Mahākāla* must be encircled by seven goddesses, three of which correspond to the three basic cardinal points (the fourth is presided over by his own *śakti)*, and the four remaining are situated in the four corners in the East – *Mahāmāyā* (wife of *Maheśvara*, riding the lion); in the South – *Yamadūti*, riding the buffalo; in the West – *Kāladūti*, riding the horse. In the four corners, the following goddesses are distinguished:

in the Northeast – *Kālikā*,
in the Southwest – *Chārikā*,
in the Northwest – *Chandeśvarī*,
in the Northeast[11] – *Kuliśeśvarī*.

The *vāhana* of each of these goddesses is a human body.[12]

The following group of Buddhist gods connected with the directions are the five *dhyāni buddha*, considered to be the most ancient gods of the Buddhist pantheon, proto-ancestors of all gods. One of them, the *dhyāni buddha vairocana* (Sanskrit 'of the sun') symbolizes the universe, and the other four *dhyāni buddha* symbolize the four cardinal points:

the West – *Amitabha; vāhana* – two peacocks;
the East – *Akṣobhya; vāhana* – two elephants;
the Center (universe) – *vairocana; vāhana* – two dragons or griffins;
the North – *Amoghasiddhi; vāhana* – two *garuḍas* (mythical birds);
the South – *Ratnasambhava; vāhana* – two lions.

The secondary directions in this group of gods are presided over by the *śaktis* of the above-mentioned gods of the cardinal points.

In the Buddhist literary monument *Niṣpannayogavali tantra*, still another group of gods of directions is described in detail; this [group] consists of ten gods: four gods of the cardinal points; four of the secondary directions; and two gods symbolizing the zenith *(uṣṇīṣa)* and nadir *(sumbharāja)*.

To this group of ten gods of the directions are adjoined the Buddhist goddesses of the six directions, the names and symbols of which are different from the corresponding deities of the preceding group.

A specific group of Buddhist goddesses also connected with the four cardinal and four secondary directions is described in *Niṣpannayogavali tantra*. These goddesses have a special place in the *maṇḍala* (the magic circle including an enormous number of gods; the place of each of them in the circle is precisely established).

The names of the four main goddesses correspond to those animals, the muzzles of which are depicted in their images:

11 [Presumably Southeast is intended.]

12 B. Bhattacharyya, *The Indian Buddhist Iconography* (Calcutta, 1958) pp. 346–47.

East – *Hayasya*, with the muzzle of a horse;
South – *Sūkarasya*, with the muzzle of a pig;
West – *Śvanasya*, with the muzzle of a dog;
North – *Siṁhasya*, with the muzzle of a lion.

To these four main goddesses are added four other goddesses with birds' heads, corresponding to the four secondary directions:

Kākasya, with the head of a crow;
Garuḍasya, with the head of a *garuḍa;*
Gṛddhasya, with the head of a vulture;
Ulūkasya, with the head of an owl.

Sometimes these goddesses are presented with human faces, and in such an instance the corresponding animal is represented separately above the head or in the crown.

10. The animals functioning as *vāhanas* of the corresponding gods of the directions are assigned to the terrestrial quarters in the following way:

Terrestrial Quarters	Groups of Gods				Goddesses with the muzzles of animals
	lokapāla	*dikpāla*	*dhyāni buddha*	*mahākala*	
East	Elephant	Elephant	Elephant	Lion	Horse
South	Buffalo	Buffalo	Lion	Buffalo	Pig
West	*makara*	Crocodile	Peacock	Horse	Dog
North	–	Man	*garuḍa*	*śakti Mahādevī*	Lion
Southeast	Ram	Ram	–		
Southwest	Horse	Man	*śakti* of the god of the East	A human body	Crow, Vulture, Owl, *gāruda*
Northwest	Deer	Deer	*śakti* of the god of the West		
Northeast	Bull	Bull	*śakti* of the god of the North		

The animals depicted in the polytheria obviously symbolize cardinal and secondary directions. The elephant is connected only with the East, the buffalo only with the South, the bull only with the Northeast; the aurochs was evidently, in later tradition, replaced by a horse (symbolizing in Hinduism, the sun), which is connected with the Southwest. In later tradition, the tiger was replaced by the lion (the tiger is unknown in the *Ṛg-Veda;* in the *Atharva-Veda* it has replaced the lion of the *Ṛg-Veda)*; it was the *vāhana* of *śakti Mahādevī* which is connected with the North. In different groups of Buddhist gods of the directions, the lion is connected with the North, East, and South.

The rhinoceros evidently may be connected with the West, which in later tradition has no fixed animal (in Hinduism – *makara*, the mythical fish with the head of a deer and the legs of an antelope; in Buddhism – the crocodile, peacock, horse, and dog).

The rhinoceros is not found among the *vāhanas* of the gods. It is not out of the question that the Proto-Indian term meaning 'rhinoceros' and also 'man' (cf. the analogical word in Tamil *kāṇṭā* 'man, male', and also 'rhinoceros')[13] was calqued into Sanskrit, not with regard to its first meaning ('rhinoceros') but in its second meaning ('man') and translated as Sanskrit *nara* meaning 'man, male, hero'.

11. On the seal MII, no. 420 is depicted a three-faced figure sitting in ithyphallic position on a low throne with the knees spread wide and the soles of the feet placed with the toes downward. The arms in a semi-hanging position touch the knees with the palms having the thumb turned outward. [The figure] is clad in a girdle; on his chest is a triangular pendant.[14] On his head he wears a fan-like headdress with the horns of a buffalo. On each arm, from the shoulder to the wrist, are eight small bangles interspersed in fours between large ones. It is not out of the question that the image is a copy of a statue of a four-faced god—the faces of which represent the directions. The orientation of the faces of a poly-faced deity according to the cardinal points is typical of Hindu iconography. Thus, for example, according to a legend expounded in the *Matsya-purāṇa*, *svayambhū*—one of the hypostases of *Brahmā*—has four faces oriented towards the cardinal points. The name *svayambhū* (more frequently *sambhū)* was also used later for *Mahādeva*.[15] In addition, *Mahādeva* himself was also represented with four faces; and even in the image of *Panchamukhī* (five-faced), he is represented as a four-faced god with the fifth face placed above his four faces upon his head.[16]

Down towards the left is a tigress with her paws stretched towards the many-faced god; above is an elephant, on the right a rhinoceros, and a buffalo with the heads facing left. In front of the throne there are two antelopes in succession turning their heads back. On the seal MII no. 222, the same figure is depicted in an analogous position and dress but single-faced and sitting on a low throne; the headdress is a branch[17] and horns. The identical figure seated on a throne is also depicted on amulets MI Table CXVI, 29; Table CXVIII, 11; MII CII, 9. On the sides are adorants (one of them holding a vessel in his hands) and cobras standing on their tails.

13 [See commentary.]

14 [See commentary.]

15 Moore, *Pantheon*, p. 104, with reference to Wilford.

16 *Ibid*. Table 15.

17 [See commentary.]

12. The many-faced figure is identified with *Mahādeva* of the Hindu pantheon (according to MI, p. 154, *Śiva* as the lord of the animals, *Paśupati).* The cult of *Mahādeva* is connected with the snake cult. Specifically, he is considered [to be] "the chief of snakes",[18] and very often he is represented with cobras.[19] The fact that the Bengali goddess of cobras, *Manasā Devī,* is considered to be the duaghter of *Śiva*[20] is evidence for an intimate connection between the cobra cult and *Śiva.* The four animals surrounding the god can be associated with the four cardinal points, as demonstrated above. The intent was to represent the god as regent of the four directions, i.e., as the lord of the universe; the representation of the tigress in a dynamic pose and orientation is sharply differentiated from the other three animals.

In the Hindu pantheon, the tigress is associated with the *vāhana* of *śakti Mahādevī;* in Hindu iconography *śakti Mahādevī Durga* or *Mahādevī* is usually represented riding the tiger.

13. On seal MII no. 347, a tiger-goddess is represented (the body of a tigress combined with a female figure). On a number of objects a scene is depicted which can tentatively be called 'tigress by a tree'. On the tree is a figure seated in a position identical to the pose of adoration, with a two-fingered right hand outstretched before him. The tigress stands with her tail toward the tree and looks with her head turned back. Obviously, a further development may be found represented on seal MI no. 357: a horned tigress half-raised on her hind legs, turning back. Behind her is a horned and tailed figure, with the legs and hooves of a bull and with his two-fingered hands outstretched towards the tigress.

Obviously, popular mythological episodes are represented here, having no clear-cut analogies in the later tradition. In Dravidian folkloric motives, themes occur which have something in common with this episode. The Gonds of Adilabad have a legend about a tiger-woman who has devoured her six husbands—herdsmen who worshipped the bull-god *Borum deo* ('the great god'). The seventh husband changed into the fruit of the mango tree, which the tigress tried unsuccessfully to eat also.[21]

14. On the seal Ch. no. 13, a bull with a human face is represented copulating with a supine goddess with a branch on her head. (According to Mackay, "bull kicking a man").[22] The bull is associated in the Hindu pantheon with the *vāhana* of *Mahādeva.* In a number of cases *Mahādeva* himself appears as a bull. The goddess with the branch on her head is evidently a representation of *śakti Mahādevī.*

18 E. Hopkins, *The Religions of India* (London, 1895) p. 397.
19 Moore, *Pantheon,* p. 36.
20 P. Tomas, *Epics, Myths and Legends of India* (Bombay, 1956) p. 37.
21 Von Fürer-Haimendorf, *The Raj Gonds of Adilibad* (London, 1948) pp. 220–24.
22 *Chanhu-daro,* p. 147.

15. On a number of seals and amulets, a nude goddess with bangles on her arms, is represented. She has a horned headdress, and stands in the *aśvattha* tree; before the goddess stands a figure with horned headdress in a posture of adoration; behind this figure (sometimes in front of it) stand a buck with human visage and a small table with sacrificial offerings.

The goddess in the tree, with horns and branches on her head, is represented separately, also, and in a number of cases the representation of the tree is stylized in the shape of an arch. In Hindu iconography we often come across the representation of a tree stylized as an arch, inside of which is fitted *śakti Mahādevī*[23] and also *Mahādeva* himself (especially *Śiva* as *Natarāja)* as well as some other deities. In Hindu tradition, the leaves of the *aśvattha* tree brush against each other like tongues of flame. It is not uninteresting to note that in ancient times the instrument for kindling fire[s] *(araṇi)* was made from the wood of the *aśvattha*.[24]

16. In a number of scenes depicting the offering to the goddess, the act of offering is accompanied by six or seven female figures in clothing with slanting hems and with branches (?) on their heads.

The seven (in Mohenjo-daro variants) or the six (in the Harappa variants) female figures accompanying the goddess in the tree may be identified with the goddesses of the Seven Rivers *(Saptasindhava)*. The chief goddess among the goddesses of the Seven Rivers was considered to be *Sarasvatī*—called 'the mother of the rivers' (Sanskrit *sindhumātṛ)*. By *Sarasvatī* was meant the extinct, now dessicated river *Sarasvatī*. In ancient Indian sources a number of different rivers, including the Indus, were called by the name *Sarasvatī*—a traditional sacred river known also in the Avesta.

In the Vedas the river *Sarasvatī* was designated as having seven sisters (in Sanskrit *saptasvasṛ)*. It is possible that in the Harappa variant, the goddess in the tree and the six sisters correspond to the seven rivers of the Punjab; and in the variant of Mohenjo-daro, the goddesses and the seven 'sisters' correspond to the Indus and its seven tributaries (in which is included the Indus itself before its confluence with the other rivers).

Sarasvatī, in Hinduism, is usually considered to be the *śakti* of the god *Brahmā*, but in some cases she is identified with *śakti Mahādevī*. For example, in the *Purāṇas*, sometimes *Sarasvatī* is worshipped as *Maheśvarī* (one of the names of *Pārvatī*, the *śakti* of *Śiva*)[25] or *Bhagīśvarī* (one of the hypostases of the *śakti* of *Śiva* – *Devī*).[26] In Hindu iconography there is a representation parallel to this theme, namely of the seven celestial nymphs, the seven apsaras

[23] *E.g.* Moore, Table 12.
[24] W. Simpson, *The Buddhist Praying-Wheel* (London, 1896) p. 108.
[25] W. J. Wilkins, *Hindu Mythology* (Calcutta, 1882) p. 97.
[26] Moore, *Pantheon*, p. 45.

(saptāpsarā), which in Hindu mythology are also considered to be water-nymphs, goddesses of rivers and wells. On one of the representations, the seven female figures are spread out in a line; at the right is a buffalo.[27] The cult of the seven goddesses is widespread in South India, mainly among the Tamils and Kanarese, who worship seven goddesses—sisters *(Māri)*. Sometimes these goddesses are considered to be rivers or sisters of *Śiva*.[28]

17. In Hindu iconography *Mahādeva* and his *śakti* are frequently represented with bangles on their arms. In South India right up to present times, the slipping on of bangles has been considered an important part of some religious rites. At the time of the holiday in honor of the Tamil goddess worshipped under the name of *Mahākālī* (the village *Mahākālikuḍa* near Trichinopoly), a ceremony of dressing the statue in bangles takes place lasting eight days. An analogical goddess, known under the name of *Kāliyammā* is considered to be an avatar of the "eight universal forces." In the district of Coimbatore, one of the goddesses subordinate to *Mahākālī* is worshipped as the personification of one of the "eight universal forces." *Kāmāṭchiyammā*, otherwise *Kālī*, *śakti* of *Śiva* is also considered to be the goddess of the "eight universal forces".[29]

18. On the seal MII, no. 510, a buffalo is depicted over which five nude female figures are jumping from the tail to the head [of the animal]. (According to MI, Vol. I, the buffalo – *vāhana* of death, *Yama* killing people.)[30]

In a series of other scenes the killing of the buffalo is represented. The figure treads with his left leg on the muzzle of the buffalo; with his left hand he holds its right horn, and with his right he stabs it in the nape of the neck with a spear. At the right there is a representation of a tree and three female figures (MII, Tablet XCI, 4). The scene with a buffalo has a close analogy in the Sumerian myth about Gilgamesh and the celestial bull, usually represented as a buffalo.

As a parallel to the scenes with a buffalo, Hindu mythology may be quoted, the variants of which are expounded in the *Purāṇas*: about the battles of *śakti Mahādevī* with *Mahiśāsura* (otherwise *Durga)*, the king of demons, having the appearance of a buffalo. *Mahiśāsura* was sentenced to death for placing himself above the gods. According to one of the versions, the gods ask *Mahādeva* to kill him, and he [in turn] asked *Pārvatī* to do it (in different variants of the myths, *Kālarātrī, Mahāmāyā, Kātyāyinī)*.[31] The myth narrates that *Mahiśāsura* proposed to the goddess, but she said she would agree only if he beat her in battle. To help herself, out of her locks she made several goddesses who took part, together with the other goddesses, in the battles with *Mahisāśura.*

[27] Moore, *Pantheon*, Tables 34, 163.
[28] H. Whitehead, *The Village Gods of South India* (Calcutta, 1921) p. 29.
[29] *Ibid.* pp. 24, 31.
[30] [See commentary.]
[31] [Should be *Kātyāyanī*.]

Finally "she kicked him so forcefully on the head with her foot that he fell on the ground", and she beat him with her trident.[32] After the victory, the goddess began to call herself *Durgā* (taking the name of the victim). It should be noted that according to Indian traditions, the wife usually takes a man's name in the female form.[33]

19. Of especial interest are the sequences of various scenes, different representations and emblems occurring on plates and triangular objects (obviously amulets and talismans).

Among these, polytheria frequently occur (cf. MI Tablet CXVI, 25; MII, CI, 12; MI, CXVI, 14; MII, XC, 13), on which are represented the animals connected with the directions. Right up to present times, in South India we encounter amulets with representations of the magic circle with eight segments, which protects against illnesses and other troubles which may arise from any of the eight directions.[34]

As a characteristic example of a more complex sequence of representations, the triangular amulet (or better, perhaps, talisman, MII, Tablet XXXII, I) may serve; on one side is inscribed an anthropo-tri-saur figure on a tree and a tigress, a swastika, and an elephant; on the second side a buck brought in sacrifice to the goddess in the tree; and on the third side the aurochs before a standard.

The anthropo-tri-saur (bull with a human visage, elephant's trunk, and tail of a tiger) has no clear analogies in the later tradition. It should be noted, however, that the animals of which it is composed are connected with the directions, and the bull is the *vāhana* of *Mahādeva*. Obviously the intent was to represent *Mahādeva*, the lord of the universe, in the image of a bull, combined with the animals of the directions.

The swastika, in later tradition, appears to be a beneficial sign, symbolizing life, prosperity, health, wealth. The right-oriented swastika is considered to be the male symbol and is connected with the spring sun, whereas the left-oriented swastika is female[35] and is connected with the autumnal sun.[36] In the instance given above, the left-oriented female swastika is the one which occurs.

The elephant in later tradition is considered to be the symbol of wisdom. The god *Gaṇeśa*, with the head of an elephant, prevents ill luck and brings about good luck. The representation of *Gaṇeśa* often occurs on women's amulets.

The aurochs was, in later tradition, obviously replaced by the horse, which was considered to be the *vāhana* of the sun-god.

[32] Wilkins, *Hindu Mythology*, pp. 247–256.
[33] [See commentary.]
[34] E. Thurston, *Castes and Tribes of Southern India* (Bombay, 1956) Vol. VI, p. 114.
[35] M. M. Underhill, *The Hindu Religious Year* (Calcutta, 1921) p. 44.
[36] Simpson, *Praying-Wheel*, p. 279.

It is probable that this triangular object is a female talisman. It is not without interest to observe in this connection that to bring a bull as an offering to the goddess of fertility is an important part of the Hindu marriage ritual.

The Proto-Indian cosmographic and mythological concepts (and the corresponding iconography) naturally, in more or less transformed shape, have unquestionably entered into the structure of later religious systems of India—Hinduism, Buddhism, and Jainism—just as the Proto-Indian culture as a whole appears to be an important structural part of the later Indian culture.

List of Proto-Indian Signs

The numbers are indicated in accordance with Langdon's catalog (MII, Vol. II, pp. 434–452).

15 21 63 66 87 91 94 96

97 118 124 135 153 175 182 183

275 287

COMMENTARY

1. GENERAL REMARKS

The most that can be said for Volčok's paper is that it was the most readable of the lot, containing an interesting if not always scholarly discussion of possible links between the representations of the seals with representations and attributes of deities of the later Indian tradition. Some of his ideas, in fact, are quite ingenious but they are usually speculative in nature and lack adequate documentation.

The discussion often lacks historical perspective and discrimination. The contemporary state of affairs in Hinduism is compared with what are presumably the very foundations of the really unknown Proto-Indian iconography and cosmography. The terminology too leaves something to be desired. He coins

the word "anthropo-tri-saur" which is not at all a happy term. *zavr* (saur) coming from Greek *sauros* meaning 'lizard' is used for a mythological figure of a bull with human visage, and an elephant's trunk and tail. Similarly "ecto-saur" is used for a five-headed starfish. One wonders why he did not use instead *therion* or *zoon* (if he needed to coin terms at all).

2. SPECIFIC REMARKS

1. He often refers to the "branch" which is worn on the head of the goddess and the supposed proto-Siva figure, but examination of the various photographs of the seals (e.g., MII, 222, XCIX, A, 430, etc.) leads one to the conclusion that this three-pronged headdress may more likely represent the prototype of the trident rather than a branch. Its designation in any case is not as definite as Volčok's tone might imply.

Further, there may actually be two types of branch or trident. (Cf. for example the seals MII 315, and 208 which bear symbols similar to the headdress worn on the various seals containing the "deity" as e.g., seal 222 where the branch or trident actually forms part of the line of symbols, or 430 where it more closely resembles the trident.) Seal no. 408 is particularly interesting since it contains both representations on the same seal in the form of parts of two symbols. It would appear that the two may be distinct signs. Volčok fails to take notice of the problem.

2. Similarly, it is not at all clear if the various representations are male or female—cf. for instance, seals MII 430, 420, 522, etc. where it is really not clear if the figures are male or female – unless long hair is taken to be a definitive identifying characteristic of sex – a characteristic which is highly questionable, especially in the Indus civilization, considering the various bearded busts one encounters with considerable buns held in chignons by a fillet.[1]

3. A particular instance of pure speculation without any documentation may be seen in the treatment of *kāṇṭā*. In the course of a rather extended discussion of the possible connections of the various representations on the seals and amulets with the various deifications of the cardinal points and subsidiary directions in Hinduism and later in Buddhism, Volčok asserts: "It is not out of the question that the Proto-Indian term meaning 'rhinoceros' and also 'man' [sic] (cf. the analogical word in Tamil *kāṇṭā* 'man, male' and also 'rhinoceros') was calqued into Sanskrit, not with regard to its first meaning, ('rhinoceros') but in its second meaning ('man') and translated as Sanskrit *nara* meaning

[1] For a discussion of the sex of the Indus deity or deities see Herbert P. Sullivan's "A Re-examination of the Religion of the Indus Civilization", *History of Religions*, Vol. 4, No. 1 (Summer, 1964).

'man, male, hero'." *kāṇṭā* in the meaning of 'man, male' is, to say the least odd; no dictionary quotes this meaning, giving only the meaning 'rhinoceros'. The author presumably had in mind Tamil *kaṇṭ-aṉ* 'warrior, husband', *kaṇ-a-v-aṉ* 'husband', Malayalam *kaṇṭan* 'the male, especially of a cat', etc.; cf. Sanskrit *gaṇḍa-*, *gaṇḍīra-* 'hero' (DED 986), which, however, can hardly be connected at all with the word for 'rhinoceros'. Further, all native speakers consulted by the reviewer refused to accept this meaning as within the realm of even remote possibility. In addition, what follows this discussion in reference to the supposed calquing into Sanskrit *nara* is ridiculous speculation. (K. Z.)

4. There are various misrepresentations of objects and scenes on the seals:

(a) what Volčok calls a triangular 'pendant' (MII, no. 420) bears no resemblance whatsoever to a pendant but is rather, either a series of necklaces or what can be termed 'torques'.

(b) the characterization by Volčok of the scene on seal MII no. 510 as the "jumping of five female nudes over a buffalo" is completely erroneous. Unlike some other seals whose images are open to more speculation[2] the scene here is definitely not one of jumping, but rather the representation of figures being thrown by the animal. This mythological scene is NOT a connection (as seems to be implied though not explicitly stated) between the bull-leaping of Crete with the Indus Valley.

(c) MII, Tablet XCI, 4 is said to represent the killing of a buffalo. Volčok elaborately outlines the tableau which this Tablet is supposed to show. However, a careful scanning even with a magnifying glass reveals no such representations. The photographs are fairly good, but the tablet itself is quite worn, and the scene of a figure with his left leg on the muzzle of the buffalo, stabbing it in the nape of the neck with a spear is nowhere discernible. Either Mr. Volčok has access to something other than the Mackay volume or he has not properly documented his discovery.

(d) Volčok refers to the object usually standing in front of the animal depicted on the seals as a "standard". Various authors have guessed that it was a manger, or an altar, or some other sacrificial object. What prompts Volčok to term it a standard is not quite clear though it is not out of the question since the object is difficult to identify. The lattice above a crescent on what seems to be a pole or stand is reminiscent of some Indian fans, possibly ceremonial fans, but again only guesses can be made as to the nature of the object. The lattice work could perhaps be a representation of woven reeds or fabric in which case it is true that a fan or standard might be a more likely guess than some of the others offered previously. The actual nature of the object will

[2] Cf. the seal Ch. no. 13 which Volčok contends (probably correctly) is a 'copulation' scene and not merely a 'bull kicking a man' as Mackay says (Ch., p. 147).

probably remain in the realm of speculation since it is unlikely that even ultimately when the script is read much light will be shed on its function.

5. In discussing *Durgā*, Volčok asserts that this goddess took this name from her victim, *Mahiśāsura* and states in support of this contention that according to Indian traditions "the wife usually takes a man's name in the female form". It is true that *Durgā* is a name of *Mahiśa* but (a) it is not true that *Durgā* took the name of her victim and called herself *Durgā* because of it; and (b) it is most definitely untrue that a wife usually takes a man's name "in the female form". She may take the name of a female mythological counterpart of her husband's name (e.g., a girl marrying a man called *Rāma* may begin to call herself *Sītā)*.

6. As a last but excellent example of lack of documentation and distortion the reader may consider Volčok's statement that bucks are offered in Hindu marriages as sacrifices. If this is so it is interesting, but this has been denied both by anthropologists and Indian informants and has hitherto been unverifiable by the editors.

3. SUMMATION

Volčok sees in the various images on the seals, amulets and plates a possible connection with representations of gods of the Hindu and later, Buddhist pantheon, folklore and other cultural items of later Indian tradition and culture. In particular, an attempt is made to effect a connection between the various deifications of the cardinal points and subsidiary directions in Hinduism, and later, in Buddhism, with the representations from the Indus Valley depicting the so-called *Paśupati*.

He traces the whole mythological history of the *aśvattha* including its relation to the banyan tree which is frequently depicted on Indian ceramics. His germinal idea consists in connecting the side branches of the *aśvattha* tree with the four cardinal points, tracing the whole development of the representations of the directions through the history of India – his conclusion being in essence that the great deity of the Proto-Indian culture is identical with the later *Mahādeva*, the lord of the directions. Such a contention is quite fascinating, of course, but, by its very nature bound to be merely speculative.

In short, Volčok's paper is just another attempt at corroboration of the conclusion accepted by most scholars that there exists still today a stratum of culture which probably dates from the time of the Indus Civilization. Further, Volčok's conclusion is in no way directly connected with the problem of the decipherment of the Proto-Indian script nor the contention that it is necessarily Dravidian. What he proposes establishes a connection between the Indus Civilization and the later PAN-INDIAN culture and religion (which is neither specifically Dravidian or Aryan).]

BIBLIOGRAPHY

Allan, J., *Catalogue of the Coins of Ancient India* (London, 1936).
Andronov, M. S., *Jazyk Kannada* [The Kannada Language] (Moscow, 1962).
—, *Tamil'skij Jazyk* [The Tamil Language, no date].
Bhattacharyya, Bh., *The Indian Buddhist Iconography* (Calcutta, 1958).
Bloch, J., *The Grammatical Structure of the Dravidian Languages*, authorized translation (Poona, 1954).
Bosch, F. D. K., *The Golden Germ. An Introduction to Indian Symbolism* (The Hague, 1960).
Burrow, T., and M. B. Emeneau, *Dravidian Etymological Dictionary* (Oxford, 1961). (= DED).
Caldwell, R., *A Comparative Grammar of the Dravidian or South-Indian Family of Languages* (London, 1875).
D'jakonov, I. M., "O Jazykax drevnej Perednej Azii" [Languages of Ancient Asia Minor], *Voprosy Jazykoznanija*, no. 5 (1954).
Dowson, J., *A Classical Dictionary of Hindu Mythology and Religion, Geography, History and Literature* (London, 1953).
Fürer-Haimendorf, von, *The Raj Gonds of Adilabad* (London, 1948).
Gadd, B. S., "Seals of Ancient Indian Style Found at Ur", *Proceedings of the British Academy*, vol. XVIII (1933) pp. 191–210.
Ghosh, A., *Indian Archeology 1960–61. A Review*, edited by A. Ghosh (New Delhi, 1961).
Gordon, D. H., *The Pre-Historic Background of Indian Culture* (Bombay, 1958).
Grierson, G. A., *Linguistic Survey of India*. vols. I–XI (Calcutta, 1889–1928).
Groznij, B., "Protoindijskie pis'mena i ix rasšifrovka" [Proto-Indian Characters and their Decipherment], *Vestnik drevnej istorii*, no. 2 (1940).
Heras, Rev. H., *Further Excavations at Mohenjo-Daro* (Calcutta, 1939).
Hillebrandt, A., *Vedische Mythology*, Bd. I, II (Breslau, 1927).
Hopkins, E., The *Religions of India* (London, 1895).
Hunter, G. R., *The Script of Harappa and Mohenjo-Daro and its Connection with Other Scripts* (London, 1934).
Knorozov, Yu. V., *Pis'monnost' Indejtsev Majja* [The Written Language of the Maya Indians] (Moscow, Leningrad, 1963).
Lal, B. B., "From the Megalithic to the Harappa: Tracing Back the Graffiti on the Pottery; Ancient India", *Bulletin of the Archeological Survey of India*, no. 16 (1960) pp. 4–24
Mackay, E. J., *Chanhu-Daro. Excavations 1935–36* (New Haven, 1943). (= Ch.)
—, *Drevnejšaja kul'tura doliny inda* (Moscow, 1951).
—, *Further Excavations at Mohenjo-Daro* (Dẹlhi, 1938). (= MII)

Marshall, J., *Mohenjo-Daro and Indus Civilization*, vols. I, II, III (London, 1931). (= MI)
Meerwarth, A. M., *Grammatika Tamil'skogo razgovornogo jazyka* [Grammar of Colloquial Tamil] (Leningrad, 1929).
Meriggi, P. von, "Zum Indus Schrift", *Zeitschrift der deutschen morgenländischen Gesellschaft* (1934).
Monier-Williams, M., *A Sanskrit-English Dictionary*, 2nd ed. (Oxford, 1899).
—, *Indian Wisdom* (London, 1876).
Moore, E., *The Hindu Pantheon* (London, 1810).
Nath, Raj Mohan, *The Matsya Philosophy and the Vedic Matsya Rase* (Gauhati, 1965).
Pillai, R. P, Sethu, N. Venkata Rao, S. K. Nayar, and M. Mariappa Bhat.,*Dravidian Comparative Vocabulary*, vol. I (1959).
Predvaritel'noe soobšchenie o dešhifrovke kidan'skogo pis'ma, (Moscow, 1964). [Preliminary Remarks on the Decipherment of the Kidan texts].
Sastri, K. N., *New Light on the Indus Civilization* (Delhi, 1957).
Simpson, W., *The Buddhist Praying-Wheel* (London, 1896).
Smith, Vincent A., *Catalogue of the Coins in the Indian Museum* (Calcutta, Oxford, 1906).
Thurston, Edgar, *Castes and Tribes of Southern India*, vol. VI (Madras, 1909).
—, *Ethnographic Notes in Southern India* (Madras, 1907).
Tomas, P., *Epics, Myths and Legends of India* (Bombay, 1956).
Underhill, M. M., *The Hindu Religious Year* (Calcutta, 1921).
Vats, M. S., *Excavations at Harappa* (Delhi, 1940).
Walsh, E. H. C., "An Examination of a Find of Punchmarked Coins in Patna City, With Reference to the Subject of Punchmarked Coins Generally", *Journal of the Bihar and Orissa Research Society*, vol. 5 (1919) pp. 1, 16–72.
Wheeler, M., *The Indus Civilization* (Cambridge, 1953).
Wilkins, W. J., *Hindu Mythology* (Calcutta, 1882).
Zimmer, H., *Myths and Symbols in Indian Art and Civilization* (Delhi, 1957).

PART TWO

PROTO-INDICA: BRIEF REPORT ON THE INVESTIGATION OF THE PROTO-INDIAN TEXTS

MOSCOW, 1968

Academy of Sciences of the USSR
Institute of Ethnography

PREFACE

Proto-Indica; 1968, the original of which was printed in English, has been reprinted here in its entirety. Except for corrections of typographical errors no editing, corrections or major additions have been made to the original text. Critical commentary follows each article as in the previous section.

A. Z.

FOREWORD

The present volume should be regarded as a sequel of the "Preliminary Report on the Investigation of the Proto-Indian Texts" published in Moscow in 1965. The articles, collected in this volume, give an account of the results of further analysis of the Proto-Indian system of writing, the thorough investigation and decipherment of which would be a most important contribution in the study of the history and culture of Ancient India. The authors of this volume give a detailed analysis of the texts under study from the different points of view (the formal structure of the inscriptions, the possible pictures), attempting at the same time to introduce into the course of investigation the various materials of the Dravidian languages, Indian mythology and iconography. The interpretation of the large group of inscriptions as being related to the sacrifice, given by the authors, is new and interesting, though some details may be revised or re-defined in the course of further research. On the whole the present volume reflects the next stage in systematic investigation of the Proto-Indian epigraphy.

This research was carried out by a group of scholars of different institutions of Leningrad and Moscow: Institute of Ethnography, Institute of Scientific and Technical Information, Leningrad State University. The whole work was guided and coordinated by the Commission on decipherment of historical systems of writing attached to the section of the semiotics of the Scientific Council on the Cybernetics Complex Problem of the Presidium of Academy of Sciences of the USSR.

Corresponding Member of the Academy
of Sciences of the USSR
Professor D.A. Olderogge

ABBREVIATIONS

AOr	— Archiv Orientalni
AN	— Akaṉāṉūru
BSOAS	— Bulletin of the School of the Oriental and African Studies
Ch	— E. J. Mackey. *Chanhu-Daro. Excavations 1935—36.* New Haven, Connecticut, 1943.
Cilap	— Cilappātikāram
DED	— T. Burrow, M. B. Emeneau. *Dravidian Etymological Dictionary.* Oxford, 1961.
Ei	— Epigraphia Indica
Grignard	— A. Grignard. *An Oraon-English Dictionary.* Calcutta, 1924.
H	— M. S. Vats. *Excavations at Harappa.* Delhi, 1940.
IL	— Indian Linguistics
ILJ	— Indo-Iranian Journal
JBORS	— Journal of the Bihar and Oriasa Research Society.
KrT	— Kuṟuntokai
K I—III	— M. B. Emeneau. *Kota Texts.* Pt. I—III.
L	— S. R. Rao. The Excavations at Lothal. *Lalit Kalā.* Nos. 3—4, April 1956 — March 1957.
M I	— J. Marshall. *Mohenjo-Daro and Indus Civilisation.* vol. I, II, III. London, 1931.
M II	— E. J. Mackay. *Further Excavations at Mohenjo-Daro.* Delhi, 1938.
Mbh	— Mahābhāratam
PN	— Puṟaṉāṉūṟu
QJMS	— Quarterly Journal of the Mythic Society (Bangalore).
SII	— South-Indian Inscriptions
TC	— Tamil Culture
IPS	— Transactions of the Philological Society

THE FORMAL ANALYSIS OF THE PROTO-INDIAN TEXTS

YU. V. KNOROZOV

0.1. The Proto-Indian inscriptions have been found over a wide territory which includes the ancient Saptasindhava (Harappa, Rupar, Kalibangan), the Indus valley (Mohenjo-daro, Chanhu-daro) and the peninsula of Katyavar (Lothal). Apparently, not all the Proto-Indian towns have so far been discovered, and the excavations in the already-known cities have not yet been completed. Thus, there is every reason to believe that new discoveries of the Proto-Indian texts will be made.

Seals and imprints with the Proto-Indian inscriptions have also been found in Mesopotamia (Ur, Lagash, Umma, Kish) and Elam (Susa) with which the Proto-Indians had trade relations.

All the Proto-Indian inscriptions found so far are dated by the III–II millenium B. C. They are all executed in the same writing, which judging from the structure of the inscriptions represents the same language, although, possibly different dialects.

0.2. Only very short Proto-Indian inscriptions have been found so far. The earliest inscriptions of all known to date are written on thin small stone plates and figurines (VI–V Harappa layers; the corresponding Mohenjo-daro strata have not been excavated). Undoubtedly these inscriptions are not the earliest samples of the Proto-Indian writing. By the time these inscriptions were executed the Proto-Indian writing was apparently fully systematised.

The oldest plates and figurines have inscriptions and representations on their either sides as a rule, and only very seldom were they executed on one side alone. Many inscriptions are repeated quite often on numerous plates.

0.3. Mirror inscriptions on stone seals predominate in later strata. These seals form the bulk of the finds. Many inscriptions are often repeated on different seals and are accompanied by various pictorial representations. The seals are square, rectangular or round.

The square seals bear a mirror inscription (usually accompanied by the picture of an animal) on their flat side, there is a knob with an aperture and a groove on the top, on the reverse. Some of these square seals have a slit for an

insert (sheath seals, MI, CIIq; MII, 95, 260, 343), but it is not known what tablets were used as inserts. In other cases similar tablets could be fastened crosswise to the flat side of the seal by a string passed through the hole in the knob or running along the groove (however, there are no visible traces of the strings left).

There are as well, round Bahrein type seals with a circumferential inscription on the flat side, a knob with an aperture and three grooves (early Bahrein type, Ur, Gaad, 1933, No. 12) or one (late Bahrein type, MII 500) on the reverse.

There are square and round seals with both sides flat (without a knob). Here the inscriptions and pictures are carved on both sides (square, MI 311 and 508, 475 and 476; MII 377, 636; round MII 604) or even on narrow rims as well (MI 227–230–356, 471–472–473; MII 405) or, as the case may be, on one side only (square MI 120, 477, unfinished ? MII, 173, 189, 299, 492, 631).

Rectangular seals have a mirror inscription on the flat side and a hole in the convex reverse side (sometimes a knob with a hole, MII 510, 661).

There are also rectangular seals with inscriptions and pictures on both flat sides or one side only.

There are several cylindrical seals of the Mesopotamian type (MII 78, 376, 488; XC, 17; Susa).

Ebony sticks with mirror inscriptions were possibly used for imprinting (MI 529–533).

0.4. Sealings are found only in small numbers. This may be explained by the fact that only baked clay sealings withstood the time.

Clay "tags" with seals imprinted on them could be fastened to the goods during packaging. The imprints of seals on trade "tags" could be preserved only in those cases when the tags became accidentally baked, e.g. when old packaging mats were burnt down (Gordon 1958, 64). Round seals could be imprinted on clay stoppers which were broken when the vessels were opened.

On some sealings discovered in Lothal several rectangular seals were found imprinted one above the other. The imprints were made on a clod of damp clay put on a stick. The clod was then placed in a special oven, covered with cane and baked (cane and finger prints are preserved). The stick burnt out and left an aperture which was possibly used for fastening (Rao, 1956-57, 86).

The bulk of the finds is made up of flat clay (sometimes faience) plates baked deliberately. These usually have imprints of two rectangular or round seals (on the obverse and reverse). The same seal is imprinted on both sides (sometimes there is room for only part of the seal). Trihedral baked clay prisms (MII, 1, 3, 8, 10, 14; XCII, 4; CI, 10, 13; CII, 14) with the imprints of different rectangular seals on each of the three facets are found as well as cubes (MII, XC, 16, 19; CII, 3) with rectangular seals printed on all (or some) sides. There are many plates with identical imprints. In the opinion of most of the authors such baked

imprints served as amulets (talismans), votive offerings or were given by the priests to the visitors of the temples as a token of their observance of a religious rite (Marshall, II, 397).

There are seal prints executed on the vessels before baking.

0.5. Apart from mirror inscriptions on seals and their imprints there are non-mirror inscriptions on stone tablets (not on miniature ones as in the early Harappa strata, but having a similar form with the seals, (MII, 327, 328, 394, 400, 401, 497), the seals themselves (alongside with a usual mirror inscription: MII 352, 587), as well as on copper tablets, ceramics, metal instruments, clay bracelets and other small objects.

All known inscriptions are, no doubt, not the only monuments of the Proto-Indian writing. The Proto-Indians possibly used to write by means of small brushes and paints on palm leaves and similar material. Thus, only short specific inscriptions survived which creates major difficulties for the study.

After the destruction of the Proto-Indian cities (about the middle of the II millenium B. C.) the inscriptions disappear. Separate Proto-Indian symbols are found on ceramics from South India dated after that time (Lal, 1960) and even on stamped coins (the end of the I millenium B. C.).

1.1. In the vast majority of cases the inscriptions consist of one horizontal line (on round seals they are circumferential) which is read from the right to the left (in mirror inscriptions on the seals, correspondingly—from the left to the right).

The proof of the reading from the right to the left may be seen in the compression of the signs on the left side of the line (i.e., at the end of the inscription) in some inscriptions, a free margin to the left of a short inscription, and, in particular, in case of an inscription being carried over to the second line (e.g., the final signs of the upper line of the inscription on seal MI 247 are carried over to the second line in seal MI 139). These observations are supported by such facts as the continuation of the inscription on the left lateral side (H. 254) and the observations on the order of sequence among the signs (Hunter, 1934; Alekseev 1965; Lal, 1966).

If an inscription is accompanied by the picture of an animal, the latter is so oriented that the inscription might be read from the head to the tail, although sometimes the animal may be oriented inversely and the inscription is read from the right to the left—from the tail to the head (H. 617, Ch. 22).

There is a small number of exceptions when the inscription is read from the left to the right (MII 394; H. 273), from the head to the tail of the animal (MII 651; Ch. 21), or from the tail to the head (MII 516; H. 217).

When an inscription has many lines, the second line and following are also read from the right to the left (MI 12, 237; 400; MII, 519, 564; H. 251), although boustrophedon is attested as well (MI 247; MII 405, 604; Ch. 4).

In some cases, especially on small stone tablets the inscription comes over

from the obverse to the reverse where it is read either from the left to the right (a variety of boustrophedon), or, as usual, from the right to the left. The inscriptions on the obverse and reverse of many double-sided seals and sealings are syntactically not connected with one another. There are cases of identical inscriptions (though with different accompanying pictures) on both sides of one seal.

1.2. The Proto-Indian inscriptions are executed in continuous lines without any intervals between words (although there are unique cases when a line may be divided into sign groups, e.g., H. 44, 658).

To identify sign groups corresponding to the linguistic units the Proto-Indian texts (converted into a digital code) were automatically processed, and all sign groups occurring two or more times (intersections in mathematical terms) were thus registered. At the same time the program registered recurrent sign combinations separated by other signs within the whole inscription (interval statistics).

To check the efficiency of this program its applicability had to be tested with regard to any continuously written text other than Proto-Indian. A control experiment was carried out with an unsegmented Egyptian text (about 1500 symbols). The experiment has shown that the number of random sign combinations is insignificant even for such a small text. It also turned out that the boundaries of the sentence are well determined. It is precisely the small size which limits the segmentation and study of the Proto-Indian texts: a text at least 10,000 symbols long is necessary for a meaningful formal study; in the opinion of some theorists this size should be by far larger. The specific character of the Proto-Indian texts (short standard formulas) presents less difficulties, since the high frequency of certain word-forms (which reflects the specific character of the inscriptions) is easily resolved when relative statistics is applied.

The control experiment was staged with only one aim of testing the efficiency of the program. Any other hieroglyphic text could be taken instead of Egyptian (thus, hieroglyphic Maya texts were processed in a previous unsuccessful control experiment at the Mathematical Institute of the Academy of Sciences of the USSR, Siberian Branch). Naturally, the Egyptian language or hieroglyphics were not supposed to be compared with the Proto-Indian language or writing.

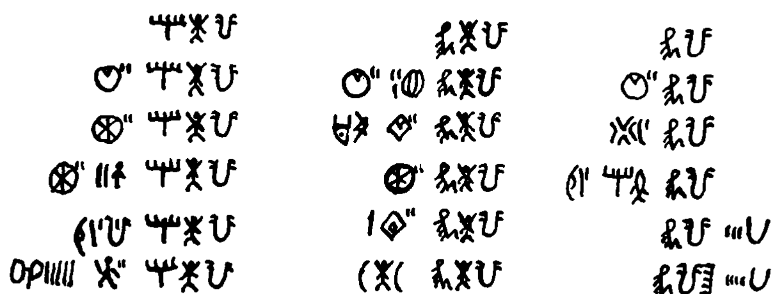
The Proto-Indian inscriptions were converted into an unsegmented continuous numerical transcription (boundaries between separate inscriptions were not marked); random combinations which occur at the junctures between the inscriptions were to be examined as a comparative material.

As a result of the work random combinations were excluded in the majority of cases. The remaining intersections which correspond to the units of the language were isolated and will be referred to as blocks.

At the same time the inscriptions were segmented on the basis of the study of their structure. It turned out that the same block is repeated in many inscriptions. In its minimal form an inscription may consist only of this principal block; in other cases the latter is augmented by supplementary ('explanatory') blocks usually from the left, but in isolated cases from the right.

Theoretical considerations led to a supposition that according to the technique used the blocks will represent not only word-forms plus the corresponding word- and form-building affixes, but those plus prepositions, particles, conjunctions etc., and even unchangeable attributes (if they are present) devoid of their morphological formants. Such attributes are practically indistinguishable from subordinate elements in unknown texts.

Below specimens of segmented inscriptions with an identical principal block are given:



1.3. Circumgraphs are often attested in the blocks. The central sign (sometimes a digramma) is surrounded in this case by two identical or similar graphemes, namely short strokes. The combination of these two graphemes without central signs makes up an independent sign. The comparison of the blocks shows that such a spelling represents an orthographic norm (rather than a linguistic one): the sign is inserted into the preceding one which consists of several elements — a split or symmetrical spelling. Below the blocks with circumgraphs are listed (only selected references are cited):

Ch.16	MI 625
H.39	MII 435
MII 285	MI 12
MII 295	MII 26
MII 44	MI 373
MII 185	MI 130

In certain blocks long strokes as well as other graphemes are used as circumgraphs:

M I 134

M II 261

H 95

M II 615

In some cases small-sized symbols are written in the middle of the preceding symbol, and the adjacent large symbols are sometimes merged into a ligature:

2.0 Constant and variable signs enter a block. Constant signs are retained in all cases when the given block occurs, they render root morphemes in all probability. Three groups are distinguished among variable signs. The first group is composed of properly variable signs (the most flexible). They occur at the end of the blocks, i.e., in the position usually occupied by form-building suffixes and other morphological formants. Other variable signs should properly be called semi-variable, because they occupy an intermediate place between the variable signs proper and the constant ones (they are closer to variable signs). The semi-variable signs are subdivided into two markedly different groups. The semi-variables of the first group always precede the variable signs proper (if these are present), and immediately follow the constant signs, i.e., they occupy a position usually taken up by derivative suffixes. The semi-variables making up the second group always precede the constant signs; together they compose a combination which remains stable within one microparadigm. In most cases the semi-variable signs of the second group are attested in one block only, or several which form a thematic grouping. The same constant combination or sign may be augmented by a whole series of unique semi-variables of the second group which seem to represent syntactical formants rather than morphological.

2.1. Variable signs proper which occupy a terminal position in the blocks are limited in number due to the standard character of the inscriptions. Some variables are combined with each other, as well as with semi-variables of the first group:

Several micro-paradigms are given for an illustration (variable signs are hyphenated):

2.2. The semi-variable signs of the II group are found only to the left of the constant ones. Some are attested in one block only. Numbers (apparently rendering numerals) are often among them:

3.1. About 350 signs compose the Proto-Indian alphabet. Many signs are relatively little conventionalised and may be interpreted. Apparently many pictographic signs were used as standard material for the alphabet (no samples of the Proto-Indian pictography have been found so far). The signs represent almost exclusively contours of whole objects. The representation of the whole by its part was used very seldom.

For the sake of economy the symbols are often turned by 90° clock or anti-clockwise:

3.2. Vertical short strokes occurring in combinations from one to nine are undoubtedly numbers and constitute a special group of signs. The Proto-Indians used decimal numeration which is proved by the rendering of numbers as well as by the discovery of a graded scale. The sign ⌒ was apparently used to denote 10. In some blocks, however, the numbers 12 and 24 are written only by means of short strokes.

There are many blocks in which numbers function as semi-variables of the II group standing before the root symbols.

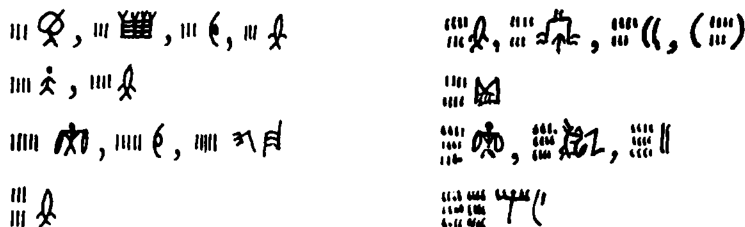
The first group is composed of blocks with varying numbers and the constant root sign:



Judging from the successive increase in numbers as well as the use of such blocks, the number represents quantity and the root sign stands for a unit of measure. Thus, the sign which represents apparently a human palm may denote a unit of measure known as 'handful' in the Indian system of measures; the symbol representing a porter denotes the measure known as 'burden'.

The symbol denotes a vessel as seen from a comparison with contemporary pictures.

The second group is made up of blocks in which a definite number forms a stable combination with a definite symbol or group of symbols:



These blocks may render stable combinations with numerals. Such stable word combinations with numerals are quite common in the languages of India.

In other cases numbers were probably used not to denote quantities but in a different meaning. Thus, numbers ', '', ''' are used as final variables. The figure four is used far too often to represent only quantities. Some combinations definitely imply a homonymic use.

3.3. Some signs may be interpreted by their shape. In some cases interpretation may be facilitated by the comparison between signs as well as by the comparison of the signs with the contemporary Proto-Indian pictorial representations and archeological findings.

Attempts at discovering a system of writing related to Proto-Indian have so far been unsuccessful. The identity or similarity of certain Proto-Indian signs with Hittite, Easter Island or other alphabets is either purely fortuitous or of a convergent nature (e.g., the 'fish' or 'man' signs).

The signs are identified with a varying degree of certainty. In some cases only a class of objects may be referred to. The following are some of the identified signs:

man
personage in stocks
runner
horned personage
a female personage with uplifted hands and large breasts
spear bearer
bow-man
a personage with two bows
adorant with a vessel
a personage with a club (warder) on his shoulder
porter
quadrupedal animal
bird (flying)

fish
carp
crab
hands
aśvattha tree
leaf of aśvattha tree
tree (palm?)
fence
mountains
vessel
bow and arrow
fish hook
harp

4.1. The excavations made by M. S. Vats[1] discovered in the early archeological levels of Harappa tiny plates made of burnt steatite. Most of these plates bear the brief incriptions of the same type, consisting as minimum of a basic block and a complementary block from the right side (so-called sacrificial inscriptions). In some cases another complementary block is added to the basic block from the left side.

The additional block from the right side consists of a radical sign preceded by the numerals (from 1 to 4). Sometimes identical inscriptions differ only by the numeral in the right complementary block:

H. 566
H. 381
H. 405
H. 508

The sign U seems to represent originally a vessel with a round bottom. The same cup is carried by an adorant in the scenes engraved on Proto-Indian seals – cf. for instance the scene with a sitting god and the scene of 'tree-

[1] See H.

worship' (MII, CIII, 9; XC, 23). Sometimes the sign U is replaced by the sign of a kneeling adorant with the cup (or adorant standing in a 'dancing' posture with the cup in hand), as, for example:

H. 372 ..... H. 412

4.2. There are more than 60 basic blocks in the 'sacrificial' inscriptions. Some of these blocks were interpreted previously as the denominations of various deities:

The basic blocks of this type have usually (in post-position) the specific variable sign, single or in combinations. In many cases, however, the final variable signs are dropped altogether. Examples:

H. 381	H. 647	H. 664
H. 497	H. 376	H. 458
H. 604	H. 378	H. 680
H. 490	H. 479	H. 607

The complementary blocks, added from the left side, are of the lesser frequency – in comparison with the right (final) block. Sometimes, between the basic and final blocks is inserted another additional block of rather different type. In those cases the block with the 'cup' sign is occasionally dropped. Cf. for instance:

H. 342	H. 586
H. 487	H. 454

The final block almost completely disappears in the late inscriptions from Mohenjo-Daro and other Proto-Indian sites. Very rarely it occurs with the numeral 4 only and even in those solitary instances is placed *to the left* of the basic block.

MII, XC, 23 MII, XC, 23

4.3. The image of the tree and the kneeling adorant with a cup we find on the sealing MII, XC, 23. Much earlier (H. 305) the sign U is stamped on the amulet at the feet of the deities. As it was pointed out before, the sign, representing an adorant with a cup, can replace the sign U in the final block of the Harappan inscriptions in combination with the numerals. If we take into account the fact, that the group of radical signs in basic blocks can be interpreted as denomina-

tions of gods and goddesses – by means of comparison with contemporary Proto-Indian images and some later specimens preserved in Indian mythological and iconographic tradition, it seems to be quite plausible to interpret the whole group of the inscriptions on tiny plates as obviously connected with a certain type of sacrifice (particularly – drink-offering). The numeral denotes the number of the sacrifices, although the forms of offering could be different (for instance two drink-offerings with two kinds of liquor).

4.4. The sealing MII, XC, 23 is a rare case of conformity between the picture (representing the process of a sacrifice) and the sacrificial inscription. As a rule, the image is not an 'illustration', but rather a supplement and has its special value, not identical with the meaning of the inscription. On the early plates we find only the image of the fish engraved after the inscription. It was probably too difficult a task to draw a more complicated picture on such miniature objects. The late Harappan prints on clay, made after specially prepared seals, bear different images and symbols at the right side of the inscriptions.

4.5. Even on early plates there are contracted inscriptions without the final block. These are the images of different animals (fish, gharial, etc.). On some plates with the complete or abbreviated inscriptions there is sometimes a drawing of the so-called 'incensory', which on the later seals, combined with the unicorn, becomes one of the most frequent types of images.

The early stone-plates usually bear the inscriptions both on the obverse and reverse side. The same case is with the later impressions on clay, where the inscription was stamped on both sides with two different sets of the seals. The basic block was impressed on the obverse side of sealing. The reverse side was reserved for the final block and the image (cf. for instance, H. 314, 324, etc.). In some cases however on the reverse side is stamped only the image of a certain deity – probably the same god (or goddess), whose name is indicated in the basic block on the obverse. On the reverse side (instead of the image of a deity) we find sometimes the image of a tree, usually enclosed in a railing or platform (H. 325, 327; cf. M II XC, 23).

4.6. The inscriptions of the 'sacrificial' type predominate on early Harappan stone plates. The later seals (no impressions of which are available now) represent different kinds of inscriptions (or – in some cases – parts of inscriptions). The inscriptions on many seals strictly correspond to the obverse inscriptions of tiny stone plates (basic block with final variable sign – ⁝), though seals with a final block of early inscriptions are at present unknown.

COMMENTARY

This second paper of Knorozov's consists of a revised summary of the procedures and conclusions reached in his first paper produced in 1965. The tone of

the paper is considerably modified for the better. To identify sign groups corresponding to linguistic units, the Proto-Indian texts (converted into a digital code) were automatically processed; all sign groups occurring two or more times (i.e., interesections in mathematical terms) were registered.[1] Thus, Knorozov states, somewhat more clearly than in the previous monograph, the major procedures carried out by the deciphering 'team'. The control language – the unsegmented Egyptian text of ca. 1500 signs – Knorozov asserts, "has shown that the number of random sign combinations is insignificant for such a small text . . . and boundaries of the sentence are well determined". (p. 100) One of the conclusions he reaches is that a text of at least 10,000 symbols in length is necessary for "a meaningful formal study" (p. 100).

The control had as its object a test of the "efficiency of the program" (p. 100). Unlike the earlier paper, where in fact the Egyptian language and hieroglyphics were compared with Proto-Indian, in this paper Knorozov states, "the Egyptian language and hieroglyphics were not supposed to be compared with the Proto-Indian language or writing". (p. 100). As regards the procedures, the reader is informed that the Proto-Indian inscriptions were converted into an unsegmented continuous digital transcription, where boundaries between separate inscriptions were not marked and random combinations occurring at the junctures between inscriptions were examined as comparative material. Thus, random combinations were exluded for the most part, and the remaining intersections corresponding to the units of the language, were isolated (referred to as "blocks".) Further segmentation in terms of structure revealed that the same block is frequently repeated – often an inscription is accompanied by supplementary "explanatory" blocks, usually on the left, but occasionally on the right as well.

The blocks were assumed to represent words, affices, and words plus prepostions, particles, conjunctions, etc., and even unchangeable attributes (if present) minus morphological formants (i.e., no concordance is necessary). The new material includes a brief discussion of circumgraphs; Knorozov includes in this designation both identical and "similar" graphemes which surround a central sign or diagram, concluding that the two signs (i.e., the circumgraph) constitute a separate sign. This follows the rather curious statement that: "the comparison of the blocks shows that such a spelling [sic] represents an orthographic norm (rather than a linguistic one): the sign is inserted into the preceding one which consists of several elements – a split or symmetrical spelling (p. 101).[2] But aside from noting these "circumgraphs" and that "small-sized symbols are written in the middle of the preceding symbol, and the adjacent large symbols are sometimes merged into a ligature", these three (possibly

[1] Interval Statistics.

[2] Hunter, *Script*.

four) obviously different phenomena are not discussed further in terms of any theoretical implications. This must be considered a major defect in the paper since it is the opinion of the reviewers (and that of a prominent writing specialist, I. J. Gelb), that before other – any other – steps are taken in a decipherment, an accurate and extensive description and assessment of all signs must be made. For the Proto-Indian script, in particular, sufficient attention has not been paid to the various (and obviously different) functions played by the various types of signs.

Knorozov then discusses the distinction made between CONSTANT and VARIABLE signs which occur in a block, asserting that constant signs in all probability render root morphemes. Variable signs consist of three groups; the first group is composed of "properly variable" (i.e., the most flexible) signs, occurring at the end of a block – presumably having an inflectional function; the second and third groups, both semi-variable, are "markedly different". One group always precedes the variable signs (if present) and immediately follows the constant signs, thus occupying a position usually "taken up by derivative suffixes". The other group always precedes the constant signs.

Then follows a statement by Knorozov which one must take exception to on the grounds of insufficient information: i.e., his reasons for the assertion that "the same constant combination or sign may be augmented by a whole series of unique semi-variables of the second group which seem to represent syntactical formants rather than morphological [ones]", which, so far as one can tell, at least from the information which Knorozov extends to the reader, is unfounded, and definitely unsupported by concrete evidence in the body of the monograph. Rather, it leads one to suspect that we are here faced by the prospect of an *a priori* desire to equate the script with a language which Mr. Knorozov had in mind previous to the analysis – namely Dravidian. One assumes that in fact this was not the case, but the factual evidence and logical basis for such an assertion is nowhere evident in the text.

Variable signs are said to be limited in number as a result of the presumably "standard" character of the inscriptions, but occur finally, and often combine with each other as well as with semi-variables (before the constant signs numbers often occur). There seem to be many small mistakes and careless use of terminology which is rather unfortunate. Thus, Knorozov says, many "pictographic" signs were used as standard material for the "alphabet [sic !]" . . . "The representation of the whole by its part was used very seldom [sic]", p. 103. His representations of ligatures (p. 102) though untranslated should have been sufficient indication that he could not possibly KNOW this to be so, his assertion notwithstanding. Similarly, since, as he himself indicates, we do not have "samples of the Proto-Indian pictography" underlying the presumably later symbols of the script, he cannot assert that "for the sake of economy the symbols are often turned by 90 degrees . . .". For a few of the animal symbols

one can perhaps assume this, but we do not know that this was not the original direction, nor do we know if economy was the motivation, if indeed they were "turned". These are all relatively minor points, but are brought up as generally indicative of much of the carlessness which might have been avoided. Objectional also are the constant overuses of words such as "undoubtedly" and "obviously".

Knorozov discusses the occurrence in combinations from one to nine of vertical short strokes, asserting that they function as numbers, and further extends himself in asserting that the Proto-Indians used a decimal system,[3] "proved" by the rendering of numbers and by the discovery of a graded scale. The "proof" is nowhere demonstrated by Knorozov, however. The statement is not supported by examples or by any other means. Many blocks consist of these number signs functioning as semi-varibles before the "root" symbols. Knorozov contends, probably correctly, judging by the successive increase in numbers as well as use of such blocks, that the number is quantity and the constant, a measure. The signs are identified in the following way:

'a handful'

'a burden'

'a vessel'

These quantities do have counterparts in contemporary Indian usage, but the question of attestability for Proto-Dravidian is overlooked.

There are other blocks where a definite number forms a STABLE COMBINATION with a definite symbol or group of symbols, presumably rendering stable com-

[3] If, however, Knorozov and his team want to read the Proto-Indian inscriptions as Dravidian, then some difficulties may arise out of his assertion concerning the decimal system of the Proto-Indians. The South Dravidian languages including Telugu allow Proto-Dravidian numeral morphemes to be reconstructed for a system with basic simplex morphemes from one to EIGHT, for ten and for hundred. However, nine is formed subtractively from ten, i.e., ten minus one, (which incidentally coincides with the Proto-Indian sign). The basic morpheme for 'thousand' is borrowed from Indo-Altaic. In the Central and North Dravidian languages, only the Dravidian numerals one and two occur in all of them. As for ten (DED 3236 Tamil *pattu, paktu)*, an etymological connection with 'much, many' (DED 3289 Tamil *pala*, Malt. *pal-; pak̲tu, pattu* (?) * *pal -tu)* is not quite ruled out. There is therefore at least some possibility of considering the octogenal system as primitive in Dravidian. Cf. also DED 678 Tamil *eṇ* 'number, calculation, etc.' with the allomorph DED 670 Tamil *eṇ-* 'eight', which would indicate that 'eight' was considered as 'the number *par excellence*' (K.Z).

binations with numerals as common in the language of India (e.g., Sanskrit *tri-pura* 'triple city', Dravidian *aṟumīṉ* 'Pleiades' etc.).

Elsewhere Knorozov does note that numbers, used far too often to represent only quantities must imply a "homonymic" use, i.e., presumably meaning a logosyllabic, 'rebus' function. E.g. ⁞⁞⁞ (((but he also includes ⁞⁞⁞ vs. ', ", ‴ and ⁞, "used not to denote quantities but in a different meaning" [p. 104]).

Knorozov attempts to identify several signs, admittedly "with a varying degree of certainty" (one might add with NO certainty until the inscriptions are actually read). Thus he identifies:

 'man', a likely identity, but not necessarily the VALUE of the sign.

 'fish', also likely.

vs.

 "quadrupedal animal" – a highly questionable identification, considering the fact that it occurs in reverse (see his own p. 103) and that most of the other animal signs are easily identifiable as such. His examples H. 566, 381, 405, 508 showing the same set of three symbols followed by one to four long strokes preceding the 'U-shaped vessel can only indicate numerals, though he does not note the fact as he is at this point (pp. 105-6) interested in describing the "sacrificial inscriptions" which occur with similar inscriptions in which the "vessel" is held by an "adorant" in a presumably kneeling position, though his characterization (p. 106) of a "dancing" posture for the H. 412 *homo* is somewhat farfetched. The characterization of these tiny plates as somehow connected with sacrificial offerings is, however, quite plausible, though whether specifically for drink-offerings as Knorozov contends, is another question.

Thus, the overall quality of this second paper of Knorozov's though a considerable improvement over the first paper, is still marred by many minor instances of carelessness. Further, major steps in the decipherment are omitted; Knorozov does not even seem to be aware they exist. Where, for example, are the grids, of signs, of the supposed inflectional endings? Where is his assessment of the precise functions of the various signs in the system of the script? Neither a formal nor an internal systemization is made except on a most primitive level. No assessment, e.g., preferably by computer, was made of the relative position of signs in relation to each other beyond the classification into variable, semi-variable vs. stable, nor has assessment of the function of the signs themselves been made. In a logosyllabic script one expects the logograms and/or determinatives to be fairly obvious but no attempt is made to separate out these signs from the other presumably logosyllabic signs – those word-signs which double as syllabic indicators or syllabic signs.

The primary defect in Knorozov's paper (and Gurov's paper as well) is the speculative and intuitive manner in which he attempts to equate the typological structure found with Dravidian typological structure – i.e., THE MANNER IN WHICH THEY SUPPLY CONCRETE READINGS. Various equations are made but no concrete internal system emerges, the inner workings of the script are not demonstrated. In fact, no system emerges which shows a Dravidian solution to be incontrovertible; the pieces of the system do not begin to fit together, nor form a clear whole (as they did in the early stages of the decipherments of Linear B or hieroglyphic Hittite). That they might indeed do so is possible, even plausible, but beyond the mathematical conclusions which must necessarily constitute only the very beginnings of the decipherment, the procedures are not 'followed up'; there is an omission of steps, where, it is true, certain correlations – ISOLATED correlations – appear to work. But because one cannot distinguish a system – or even a part of an internal system – the whole so-called 'decipherment' remains a tissue of speculations – often interesting and attractive speculations, but only speculations, – in fact, not much better than those of Father Heras', whose contention that Proto-Indian was in fact Dravidian predates the Soviet monographs by at least twelve years, though his "reconstructions" were, of course, linguistically preposterous. Knorozov, in fact, admits he has not succeeded in deciphering the script but lays it to the lack of longer and more numerous texts, never realizing he could have perhaps gone further in assessing the nature of the script than in fact he had done.

TOWARDS AN INTERPRETATION OF THE PROTO-INDIAN FIGURES

B. YA. VOLČOK

0.1. The Proto-Indian inscriptions are usually accompanied by various pictorial representations (the figures as well as inscriptions on the seals were mirror). Various figures are also depicted on some pottery. Many figures were found among the monuments of the Proto-Indian culture.

The signs of the Proto-Indian writing include more or less conventionalised representations of mythological personages, animals, plants, various objects and emblems. In some cases it is possible to identify objects represented by the signs with the contemporary Proto-Indian figures.

The comparison of the inscriptions and pictures as well as the formal analysis of the former allows to elicit the blocks which render the names of certain mythological personages and to establish a number of names of various mythological personages whose representations have not yet been found among the Proto-Indian monuments.

It is possible that some Proto-Indian mythological personages and deities adapted *mutatis mutandis* by the later Indian religions were adopted through their medium by the peoples of the Indian sub-continent, among their number – by the Dravidians.

0.2. Certain Proto-Indian mythological personages go back to the remote Neolithic past. Thus, a female personage with uplifted hands, a common Neolithic symbol of the fertility goddess, is represented only by the sign, whereas the corresponding deity is usually represented as a woman with the hands down.

0.3. Some mythological personages may be compared with the well-known deities of the great religions of India. But it should be remembered that the chronological gap between the Proto-Indian culture and the material used for comparison is about one and a half thousand years or even more. Therefore a complete identity of the objects under comparison is simply unthinkable. One can only speak of separate Proto-Indian elements being included into the later Indian culture.

Apart from the iconographic material from later religions the data from the ancient Indian literature containing the descriptions of deities and their names

may be used for comparison. Evidently the Sanskrit had copied the names of some Proto-Indian mythological personages and deities. This fact enables us to examine the names of those deities whose representations in the Proto-Indian culture have not been preserved.

0.4. The Proto-Indian texts include stable combinations of the signs with numerals. These combinations form a special group of blocks. The presence of a large group of words and word combinations with a numeral as the first component is also very characteristic of Sanskrit. The numbers three, four and seven are the likeliest first components in the Sanskrit (as well as in the Proto-Indian) combinations of this type. This group of vocabulary in Sanskrit as a rule is semantically related to mythology and renders mainly the names and epithets of the gods and other mythological personages as well as the names of different objects mainly connected with religion and ritual. Thus the blocks 'three fences'), ('three gods with the sticks') etc. could be regarded on analogy with the Sanskrit stable combinations 'tri-pura', 'tri-yama' etc.

1.1. The Proto-Indian figures include personages which have pictorial correspondences among the signs of the Proto-Indian inscriptions. Thus, an impression from a tri-hedral object (H. 305) depicts a male personage with a stick on his shoulder and a cup at his feet; this personage corresponds to the sign from the inscriptions. The images of deities with the stick on the shoulder were retained in the late Indian iconography. Thus, in such a posture is sometimes represented the god Yama (as a number of other gods – Bhairava, etc.). Significantly, on some Proto-Indian burial vessels there are depicted the figures of dogs (dog are attended to Yama, as a god of death). It is possible, that both the figure on the trihedral object and the corresponding sign denote a deity which – in some aspects – could be regarded as one of the 'predecessors' of Vedic Yama or some other god with the analogous functions.

This iconographic feature of Yama is reflected in Sanskrit where he has the constant epithet of *daṇḍin* – *daṇḍadhāra* 'carrying or holding the club'.

1.2. One of the epithets of the goddess with the uplifted hands is expressed by the sign . The same sign with the numeral seven preceding it constitutes a block which renders the name of the seven female personages accompanying 'the goddess in the tree'.

The block can, be found on the trihedral amulet (MII, CI, 7) accompanying the block (presumably the name of the Great Goddess). Other amulets of this type bear scenes and figures including the image representing the goddess in the tree. The image of this goddess is accompanied sometimes by seven female personages (for example MII, 430). On the amulet MII, CI, 7 the figures and scenes are replaced by the inscriptions. It is possible therefore that the block found in combination with the name of a goddess could render the denomination of these seven females (the sign probably a representation of the rainbow).

As it is mentioned earlier *(Predvaritel'noe soobščenie)* the seven female personages may be compared with the goddesses of the Seven Rivers (Sanskrit *Saptasindhava)* as well as with the seven apsars – water nymphs, goddesses of rivers and wells. The apsars are sometimes regarded as personifications of the rainbow. The Sanskrit word *vidyut-prabhā* used in the *Māhābhārata* to denote the apsars is interpreted as 'shining like a lightning or rainbow' or 'originating from the lightning or rainbow'.

Apparently, the block may be interpreted as 'seven rainbows' (the rainbow consists of seven distinct colours) or 'seven apsars' and represents the designation of the seven female personages accompanying 'the goddess in the tree'.

The block probably represents the name of 'the rainbow goddess'.

1.3. The block may be interpreted as 'the shining or luminous goddess' *(mīn* 'fish' in the Dravidian languages may, as has already been noted, mean 'fish', 'star', as well as 'to shine', 'to sparkle', 'to glitter').

In the *Māhabhārata,* the Laws of Manu and other monuments one comes across a personification of the sun's spouse Prabha. Sometimes she appears as the mother of the morning, noon and afternoon; or she may be identified as an apsar- (in the *Māhabhārata)* or Durga (in *Harivaṁṣa* and the *Purans).* Prabha- 'light'-is one of the names of Parvati, Šiva's wife.

The Sanskrit word *Prabha* is derived from the root *bha*= 'to shine', 'to beam' and, possibly, may be interpreted by analogy with Dravidian *mīn.*

1.4. The Proto-Indian sign – a personage with a spear in his hand , may be interpreted by comparison with later Indian iconography.

The personage with a spear in his hand has direct analogies among the signs found on the punch-marked coins. It is interpreted as Skanda (Cunningham, Allan).

Skanda is a warrior, a god of war, Šiva's general in the war against the enemies of the gods. He is known under many names and has many iconographic variants. He may hold various attributes in his hands, one of which – a spear – being obligatory for any representation of Skanda. The spear may assume different forms. The Sanskrit names of *Skanda Saktyayudha, Saktidhara* describes him as a spear-bearer. Various epithets of *Skanda* with the general meaning of 'spear-bearer' are widely used in the Dravidian literature as well.

Apart from the signs of writing, the personage with a spear in his hand is found among Proto-Indian figures as well. In the scene depicted on the seal MII, 279; XCII, 11, one finds a personage slaying a buffalo with his spear. An evident parallel to this scene is found in an episode from the late mythology of the killing of the demon-buffalo Mahiṣa. This motif has many variants in the ancient Sanskrit monuments. The feat of killing Mahiṣa is ascribed to several dieties, Skanda among them. According to the myth related in the *Māha-*

bhārata, Skanda appeared in this world in order to head the army of the gods in their struggle against various demons. Among other demons slain by Skanda one finds Mahiṣa. The details given in the *Māhabhārata's* version of *Mahisamardana* (the killing of Mahiṣa) exactly correspond to the scene on the Proto-Indian seal.

1.5. A flying bird with the head turned to the left is depicted on the obverse of the two-sided seal H. 225. Two snakes are placed above the spread wings; there are mountain symbols on the sides below. The reverse bears a cross.

M. Vats compares this bird with the sun bird Garuda, the vahana of Viṣṇu. Such an interpretation is quite appropriate and may be supported mythologically. The scene depicted on the seal may be interpreted in terms of the myth about Garuda and the snakes (the sons of Vinata and Kadru, two sisters, from one common father Kasyapa – the Polar Star) which was widely known in ancient India.

Such an interpretation of the scene from the seal is supported by the presence of the mountain sign, a detail disregarded by M. Vats. The figures of two mountains on the sides of Garuda which itself symbolises the sun may be interpreted as an indication of the sunrise and sunset.

In an Indian epigraphic monument dated by the XI century A. D.[4] the following detail is present in the description of the cosmic Meru mountain: there are two mountains – Udaya-giri and Asta-giri – where "the celestial star (sun) dwells when it rises or sets" (quoted after Bosch, 1960, p. 142).

The earliest representation of Garuda appears to be the figure of a bird engraved among other animals (near a five-head snake) on the eastern gate of the stupa in Sanci. In the art of Gandhara Garuda was depicted as a mighty eagle. In the Gupta period Garuda was portrayed on golden and silver coins and on column capitals. Garuda was, apparently, the royal emblem of the Gupta rulers and was represented as a huge bird with the spread wings.

In the Proto-Indian texts the name of Garuda is probably represented by the sign of a flying bird with the preceding epithet.

2.1. Figures are found (although not very often) already on tiny stone plates with inscriptions – the oldest discovered so far (Harappa). Later these plates are replaced by clay ones with inscriptions and figures imprinted by means of stone seals. The inscriptions and figures imprinted on the clay plates are in some cases those found on earlier stone plates.

There are many tablets on which the same seal was imprinted. In the opinion of many scholars, baked clay plates, trihedral prisms and other objects were of a ritual character. Thus, E. Mackay, their first student, supposed that they served as votive offerings: "possibly they were distributed by priests in the temples, or, what is more likely, they were bought from the priests as a proof of performing religious duties" (Marshall, 1951, v. II. p. 397).

2.2. Some scenes on the Proto-Indian seals and amulets undoubtedly denote offerings. Such are, in the first instance, the scenes depicting adorants with a

cup in hand which resemble the writing signs: e.g., one of the adorants holds a round-bottom vessel in a scene which depicts a deity on the throne with two kneeling adorants to the deity's right and left (MI, CXVI, 29; CXVIII, II; MII, CII, 9); in the scene 'offering to the tree' there is a kneeling adorant with a round-bottom vessel in his hand in front of the tree (MII, XC, 24).

Apart from these scenes which apparently portray a drink-offering (although, food could also be offered to the deity in the vessel) other forms of offering were depicted on the Proto-Indian objects as well.

Thus, in the scene on the seal MII, 371 'the goddess in the tree' is portrayed as well as a goat with 'a human face' and a goddess in the posture of adoration. There is a sacrificial table (altar) behind her with an obscure object on it. Apparently, this scene depicts a solemn offering probably connected with a wedding ritual.

It is quite probable that a 'feeding-rack' repeatedly found in front not only of the domesticated bull and buffalo but also of the elephant, rhinoceros, and tiger is related to the offering to the deity in the person of its sacred animal. The scene depicting a snake drinking from a vessel standing near a tree may be interpreted in the similar way.

2.3. It is well known that offering is the predominant form of worship in India since the earliest times. The Vedic and post-Vedic literature contains rich information on the character and form of the offering. These monuments describe the offering and prayer as the two major Vedic rituals. There are numerous indications that drink-offering was common in the Vedic and post-Vedic period, the ritual vessel thus being a prominent part of the procedure. The ritual vessel is mentioned (under different names) in early Sanskrit monuments. It was depicted in the Indian iconography as one of the attributes of some deities.

2.4. As it was noted above, the so-called 'sacrificial' inscriptions contain a block, consisting of the sign U (representing a cup) in combination with the numerals from one to four. It is significant that in some cases the cup-sign is accompanied by little circles, probably the representation of drops. In ancient India the different types of sacrifices (especially the offerings to the god of fire) were made not simply by pouring but by sprinkling the liquid (water, ghee, wine) into the fire.

2.5. The use of the numerals from one to four before the symbol of the cup may serve as a proof of the sacrificial character of these inscriptions and indicates some possible four types of offering.

Cups appear in the Indian mythology as the vessels from which the gods are drinking. They were made by the semi-gods Ṛbhu which are sometimes regarded as the personification of three seasons (Ṛbhu, Vibhu, Vaja). The semi-gods made four cups out of one which belonged to Tvaśtri, the god creator and Ṛbhu's teacher in the crafts. The four cups are sometimes related to the four phases of the moon. Possibly such an interpretation of the four cups is somehow

connected with the custom of a four-day offering to Soma, the moon *(caturvīra)*, or with four kinds of the offering to the same god *(catur-saṁstha)*.

Different Sanskrit monuments include information on other four-fold types of offering in old India. Thus, *Apastambha Dharma-sutra* relates about four offerings: *Aśva* 'horse', *Puruṣa* 'man', *Pitri* 'ancestors' and *Sarva* (complete offering or an offering of all types). Cf Bötlingk, 1884, v. II, p. 128 etc.

The form and contents of the offering could undoubtedly change during the extensive period which separates the Proto-Indian culture from Vedic and Post-Vedic. This, however, cannot deny a certain continuity between the Proto-Indian inscriptions consisting of the cup sign plus the numerals from one to four and the four-fold offering of the later classical religions of India.

2.6. The final block of the early inscriptions is often accompanied by the circle with a dot in the centre. Sometimes the circle or circles (from one to four) may immediately follow the first half of the inscription thus replacing the cup with the numbers. The circle with a dot apparently denoted the eye. The same circle with a dot in the centre denotes the eye in some Proto-Indian representations of the animals, e.g., fish, hare or bird. This sign is also found in later epigraphic monuments.

Various Sanskrit words denoting the eye may also mean a round depression in the ground used for offerings.

It may thus be supposed that the representations of the eye (from one to four in number) found at the end of the inscriptions under examination denote some types of offering just as the "cup symbol" plus the numerals from one to four.

COMMENTARY

What is true about Volčok's earlier paper (in Part One of this volume) holds good for this paper as well. In fact, if anything, the later paper is less concrete than the earlier one. Essentially this paper is a repetition of the preliminary one, which is to say – interesting, but not especially significant.

PROSPECTS FOR THE LINGUISTIC INTERPRETATION OF THE PROTO-INDIAN TEXTS (ON THE BASIS OF THE DRAVIDIAN LANGUAGES)

N. V. GUROV

0.1. The data provided at present by comparative Dravidology show that the Harappa civilisation chronologically coincides with the period of the single Proto-Dravidian language (Zvelebil, 1965, 375-376; cf. also Andronov, 1964, 62-79). The earliest written monuments in the Dravidian languages (Tamil Brahmi inscriptions found in 1903–1906 near Madurai and Tirunelveli) were created about III century B. C. (Mahadevan, 1968, 1-2; cf. Zvelebil, 1964, 547-549).

In our attempt to confront the Proto-Indian inscriptions with the copious data of the Dravidian linguistics we are bound to proceed from genetic and typological reconstructions, based upon the facts of 'living' languages, all of them at least 1500 years 'younger' than the language under study, and most of them spoken in the regions hundreds of miles distant from the Indus Valley. Any 'asterisked' form remains very much a matter of convention, while in the given case the sphere in which such a reconstruction can be used as well as the possibilities of its cross-checking are severely limited by, firstly, the mixed character of the writing, and, secondly, the extreme brevity of the texts coupled with very specialised contents.

Nevertheless, if one takes into account some specific factors in the historical development of the Dravidian languages, it appears to be plausible and even possible to cross such an extensive gap in space and time.

Genetic divergence in the Dravidian family has not gone as far as among, say, Indo-European or Tibeto-Burman languages. All Dravidian languages with a possible exception of Brahui developed for many centuries within rather a limited area under similar cultural and historical circumstances, which could have facilitated the preservation of many common features in grammar, phonology and vocabulary.

Finally, in recent years Dravidology has made a promising advance: many new valuable materials have been published and a number of important regularities in the historical development of the Dravidian languages have been established. Now attempts at reconstructing Proto-Dravidian can be carried out on a sound linguistic footing.

0.2. The Proto-Indian inscriptions are characterised by a limited number of variable signs with a restricted distribution.

Any attempt to make a reliable comparison of the Proto-Indian variables (and their conjunctions) with the definite combinations of Dravidian affixes appears therefore unreasonable and even impossible. In the process of investigation of the Proto-Indian texts it is proved to be necessary to draw some additional data: the positional characteristics of the blocks and their probable semantic interpretation.

Radical blocks include a number of relatively unconventionalised signs which could thus be easily interpreted semantically. This is certainly true of stable combinations with numbers, as the latter in most cases allow unambiguous interpretations. Constantly recurring combinations of *one* number (N) with *the same* symbol (R) are in all probability unrelated directly to quantitative enumeration of objects, but rather express a single semantic complex or a group of related notions, i.e., they are 'phraseological units'. Many students of the Proto-Indian culture and writing expressed suppositions about a ritual nature or relationships of many inscriptions. It would be instructive to compile a full list of the Proto-Indian blocks which include unconventionalised signs and compare this list with that of terms and stable combinations semantically related to the conceptual field of mythology and including one common element (e.g. numeral).

The sources for the second list should be looked for in the oldset monuments of the Tamil literature and epigraphics (in the first place the Tamil inscriptions in the Brahmi script and literature of the I–III centuries A. D.), the folklore and myths of the 'illiterate' Dravidian peoples and, finally, the monuments of the ancient Indian (Sanskrit) epic (including the earliest puranas). The assumption is that in ancient India the composition of the rite and, consequently, the ritual terminology are remarkably stable owing to which the linguistic consciousness of the Indians and, particularly, Dravidians could retain many pre-Aryan ritual and mythological features.

In certain cases the interpretation of the radical blocks permits not only to establish the functional value of the variable symbol following the unit, but to make definite suppositions about the meaning of the inscription as a whole by comparing it with a hypothetically identical structure of the Dravidian text (namely, standard formulas attested in the Tamil brahmi inscriptions as well as in Tamil, Telugu, Kannada and Malayalam inscriptions of the VI–X centuries A. D.).

These assumptions are only relevant with regard to the present stage of the Proto-Indian studies and do not cover all eventual inferences from either Dravidian or Sanskrit.

0.3. Some characteristic features of the Dravidian morphology, morphonemics and syntax could determine to some extent the application of a morpheme-

syllabic system of writing for a Dravidian-type language. We have in mind, first of all, the following phenomena:

1) the morpheme combinations within a word-form is characterised by weak fusion: morphonemic changes at junctures occur only in very restricted cases;

2) the root-morpheme which occupies the inital position in the word-form is distinctly separated from the non-root (form- and word-building) morphemes agglutinated to the former as suffixes;[1]

3) the root morpheme is equal in its length to the syllable; two types of roots are distinguished: (C)V̄̆= and (C)V̆C =. (Krishnamurti, 1958, 260; Zvelebil—Glazov—Andronov, 1967, 12, 14, 95, 117);

4) as the comparative studies have shown the morpheme types =CVCV=, =CCV=, =VCCV̆= etc. appear as a result of a contraction of two morphemes of the type =(C)V̄̆(C)=, preliminary statistics shows that monosyllabic morphemes =V(C), =(C)VC constitute a substantial proportion of the non-root (word-and form-building) morphemes in the oldest Dravidian texts (Krishnamurti, 1961, 136).[2]

5) word- and form-building morphemes often receive no explicit (sound) expression, thus many words and word-forms coincide formally with the monosyllabic root morpheme (cf. for instance Tamil ī 'fly', ē 'increase, abundance'; *uḷ* 'interior of place; mind, heart'; *kai* 'hand', *kā* 'defence'; To. *kö.r* 'pond, tank'; Go. *sēr* 'plough'; Mlt. *nan* 'another'; Br. *bā* 'mouth'; *bil* 'bow').

6) the use of subordinate words for analytic form- and word-building is characteristic even for the earliest monuments of the Tamil Sangam literature (I–III centuries A. D.).[3]

The work of all these factors may be summarised in the following equations which characterise a number of situations in the Dravidian languages:

morpheme = syllable
lexeme = syllable
morpheme = lexeme

In some cases we have even a tri-partite equation

morpheme = lexeme
⧹⧹ ⫽
syllable

[1] This feature is regularly pointed out in all general works on the morphology of Dravidian languages. Cf. Bloch, 1954, 1—2; Kuiper, 1948, 17; Meerworth, 1929, 221; Andronov, 1965, 45—46.

[2] Monosyllabic non-root morphemes comprise 49.5% of all derivational and word-changing affixes in the usage of Perunkundrur Kishar, a II-century A. D. Tamil poet. The percentage of monosyllables among the noun morphemes is 58%, among the verbal morphemes — 38.6%. (Zvelebil—Glazov—Andronov, 1967, 11—109).

[3] Zvelebil—Glazov—Andronov, 1967, 20, 24, 133, 144; cf. Minakssisundaran, 1965, 35—38.

In the Dravidian text written down with a morpheme-syllabic system of writing a monosyllabic morpheme will presumably be rendered by one or – if the writing is strictly syllabic – two signs at most apart from the determinatives and phonetic complements. The regular pattern of joining the root and non-root morphemes in the Dravidian languages (non-root morphemes beginning with a vowel are joined to the roots ending in a consonant and vice versa) May be of a great epistemological value in establishing the functions of separate symbols and their phonetic value.

1.

Some Proto-Indian inscriptions contain a group of blocks with the final digramma [signs]. In certain cases the whole inscription consists of a single block of this type. It seems quite probable that the blocks delimited by the signs [signs] are in fact names of different persons and mythological figures – proper names of different persons and mythological figures – proper names, titles, names of offices and professions, names and epithets of the deities, etc.

In Dravidian languages proper names (as well as other classes of names listed) include usually the denotatum of the name-bearer (referent) as the final component. The denotatum of the name-bearer may be expressed by:

1) the gender (pronominal) suffix (Ta. *-ā̆n*, *-avan̠* (m.), *-aḷ*, *-avaḷ* (f.); Ma. *-an* (m.), *i* (f); Ko. *-n*(m.)*-y*, *-i*(f.); Ka. *-anu*, *-avanu* (m.); *-aḷu*, *avaḷu* (f.); Te. *-ḍu*, *-vā̆du* (m.), -(r)*ālu*, *-di*(f.); Kui *-enju* (m.), *-aḷi*(f.); Kur. *-as*(m), *-ī*(f) etc.)

2) synsemantic word with the meaning 'male person, man' (or respectively – "female person, woman"); this meaning is often specified according to the social and biological features: "lord (lady)"; 'father(mother)'; "elder brother(sister)" etc. Cf. Old Tamil *-ā̆ntai*, 'father, ancestor';[4] *-mān*, (< *makan*) 'son; man, male person; husband'; *ammai* 'mother, goddess'; *makal* 'daughter; woman, female; goddess'; *āḷan̠* 'master, possessor; husband'; *kiḻān* 'old man; proprietor, owner; lord, master'; Old Telugu (inscr. VII –X century AD) – *bhaṭāra* 'lord'; *-raṭṭa-kuṭṭa*, *-raṭṭaguḍḍa* 'chieftain'; *bōya* 'a village officer'; *-ayya* 'father; honourable man'; *-anna* 'elder brother', *-amma* 'Mother goddess'; *Ko*. *-ayn* 'father'; *-av* 'mother'.

In feminine names 'denotata' are found much more seldom than in masculine ones.

The part of the name immediately preceding the 'denotatum' (as a rule the Dravidian name has several components) is in the attributive relation to the latter, it is thus expressed by a noun (or nominal group) in the Attributive (Oblique) Case.

[4] About the meaning of ā̆ntai cf. Mahadevan, 1968, 27, where the author disproves the opinion of the medieval commentators of the Sangam literature who regarded ā̆ntai as ātan̠ + tantai ("father of Ātan").

E.g., many Old Tamil personal names as *Eyiṟṟiṉār*, *Eyiṟṟiyār* (PN 213) derived from *eyil* "fortress": *Māvaḷattāṉ* (< *ma* "great" + *valam* "wealth, riches" PN, 43); *īmattu-p-Pūtan* (< *īmam* "burning ground, funeral pyre" + putan "demon, ghost"). Analogical structures have the Telug proper names found in the eldest inscriptions: *Tirummu-nūḍla raṭṭoḍlu* (SII X –598). *Mēlkurti Caṇḍiyaṇṇa* (EI XXX – 280) etc.

1.1. It has already been noted that the "denotatum" is the final component in all Dravidian words. The formal analysis of the inscriptions under study has shown that the blocks with the final signs are attested almost exclusively at the and of an inscription. As inscriptions on seals and amulets are very likely to include proper names, names and epithets of deities, names of professions or relation to tribal and social affiliations, the digramma was conditionally identified with 'the masculine denotatum' of the Dravidian onomastics. The author is in complete agreement with the interpretation of the sign as the common Dravidian Oblique Case morpheme =*t*= (Predvaritel 'noe soobščenie', 1965, 50).[5] The phonemic and morphemic values of the sign should be left open so far because non-root morphemes should be reconstructed with utmost care, taking into consideration new additional data.

1.2. Similarity with the Dravidian names may be established not only in the structure of the Proto-Indian blocks with the final digramma but in their semantics as well. The authors of "Predvaritel'noe soobščenie" (p. 51) have interpreted the combination as the name of the Pleiades (cf. Ta. *aṟu-mīṉ),*[6] on the basis of the homonymy of two Proto-Dravidian roots *mīn*=//**mīṉ*= 'shine, sparkle, glitter' and **mīṉ*, 'fish'.[7] The tetragramma attested in the inscriptions MI 128, MII 233 may be interpreted by analogy with one of the epithets of the god Skanda (Murugan) *aṟu-mīn-kātalaṉ* '(beloved) son of six stars (fish)'[8] which was wide spread in the Old and Medieval Tamil literature. This combination may be interpreted not only as the name of a deity but as a personal name of a man; this practice was common in the Dravidian anthroponymics and remains so now.

The combination (H. 164, H. 168, H. 141) may be similarly explained. The Old Tamil *mummīṉ* (literally 'three stars' is the name of the fifth 'lunar

[5] Cf. our review of this work (Gurov—Katanina, 1967, 175); cf. also Heras, 1940, 13, 62.
[6] About the possible etymological relationship between Proto-Dr. *mīṉ = 'fiah' and *mīṉ = // * 'mīṉ = *to shine' registered already by R. Caldwell (1856, 446—447); cf. also Ramsswami Aiyar, 1944, 142—150.
[7] Certain supplementary considerations cf. Gurov—Katenina, 1967, 176.
[8] First registered in one of the earliest Tamil dictionaries "Tivākaram" (VIII A. D.). It is noteworthy that there is no exact correlate to this name among the Sanskrit names of Skanda listed in the "Mahabharata" (III, 232, 3—9). The closest would be Ṣaṣthipriyaḥ which in B. L. Sairnov's Russian translation sounds as "the friend of sasthi (Parvati)" (1958, 277).

constellation'. The corresponding Sanskrit term *mṛgaśīrṣa=*, *mṛgaśīras=* is attested in proper names ('born on the fifth day of a lunar month').[9]

1.3. The sign appears at the end of a block without its usual neighbour in a number of texts (H. 92, MI 168, MI 242, MI 288, MI 553, MII 249, MII 445, MII 595 etc.). There are reasons to believe that the sign also functions as 'the denotatum of the name-bearer' at least in several cases, namely in two-sign inscriptions like (MI 288) or (MI 168). (Let it be remembered that the formal expression of the Attributive Case before the denotatum was not a strict rule in the Dravidian names).

Special attention should be devoted to the digramma (MI321, MII249). The most probable supposition appears to be that in this case (as, indeed, in others) the numeral 'four' (the *nā̆l*=kV= DED 3024) functions as an equivalent of another Proto-Dravidian lexeme **nal*='good, correct, kind; nice, best' (DED 2986). From the point of view of diachronic phonemics the possibility of such an equivalence is supported by the presence of a short vowel in various derivatives from the word 'four': To. *nal poθ* 'forty'; Koḍ *nanna.lï* 'by fours'; Te. *nalguru* 'four persons'; Nk. *nallaḷ* 'four women'; Ga. (S.) *nalgur* 'four' (*masc.*); Kui (Friend-Pereira) *nal* 'four'; *nalgi* 'four things'.

(It should be pointed out that the short variant of the Proto-Dravidian **nā̆l=kV=* appears mostly in these cases when it is combined with a derivational morpheme or enters a word combination.) If a possibility of such an equivalence is accepted, the digramma may be accounted for by analogy with such proper names as the Old Tamil *Naṉṉaṉ* (PN, 151), Toda *Naso.n*, Skr. *Nala=* which according to M. B. Emeneau goes back to the Dravidian root *-*nal=*.

Another consideration offers fresh possibilities for identifying the sign with the **nal=*. The characteristic feature of the secondary (non-quantitative) use of the sign in Proto-Indian texts is its structural irrelevance: the symbols and their combinations which follow this symbol (such as etc.) are regularly attested without this 'attribute' in other inscriptions. The use of the epithet *nal=*, *nalla=* in the Old Tamil anthroponymics is marked by similar specific features. The epithet *nal=* offers a supplementary qualification of already available names without being an obligatory structural element: *Nallantuvaṉar* (AN, 43), cf. *Antuvañcattaṉān* (AN, 71); *Nallurutiraṉ* (PN, 190), cf. *Uruttiraṉ* 'Rudra, Šiva'; *Nakkīraṉ* (AN, 57 ff.), cf. *Antuvaṉ Kīraṉ* (PN, 329).

[9] The name Mṛgaśīrsah is given to the "king of Naga (snekes)" in the Buddhist treatise "Karandevyūham" (12). "Lunar constellations" are quite often attested in the Old Indian anthroponysis, cf. such masculine names as Ārdreksa, Puṣys-, Mūla-, Śraviṣṭhoka- derived, respectively, from the names of the 6-th, 8-th, 19-th, and 23-rd "lunar house"; cf. also feminine names — Rohiṇī, Revatī, Magā etc. The name of the full moon day Sinīvalī is at the same time the name of Devāsena, the wife of the god Skanda; (cf. Hopkins, 1915, 70.)

2.0. Most of the early Harappan inscriptions are engraved on tiny stone-plates. The different extra-linguistical reasons led the scholars to a tentative conclusion about some relationship between the contents of the inscriptions and ritual offerings to various deities. Certain supplementary considerations arising from the introduction of the Dravidian material will be discussed below.

2.1. The reverse of the stone plates with inscriptions usually bears a digramma consisting of numeral (from one to four) and a sign ('cup'). This block could be interpreted as the name of the sacrifice plus the indication of the number (or type) of offerings. The Dravidian material throws some light on the choice of this symbol to express an offering. The Proto-South-Dravidian **vēḷ=pV=* (DED 4561) is to be regarded as one of the oldest Dravidian words meaning "offer, sacrifice" (the Tam. *vēḷvi* is attested already in the I–II centuries A. D., cf. AN, 220). The root **vĕḷ=* 'to offer, to bring offerings' and its derivative *vĕḷ =p(u)* 'sacrifice' are not etymologised in the Burrow-Emeneau Dictionary (i.e., DED).

Meanwhile this etymon can be related to the PDr. **veḷ* –/ /**viḷ* – 'outside, exterior' $>$ **veḷ* – (C) –/ /**viḷ*- (C)- 'to pour (out), throw(out), expel'. (Cf. Ta. *veḷik-kiṭu* 'to set out', Te. *velucu* 'to drive, send out'; (K) 'to shed (as tears)'; to stop, cease (as rain)'; Pi. *valip* – 'to expel, drive away' (DED 4526). (Cf. also DED 4529.) Ta. *veḷḷam* 'water, flood, deluge'; Ma. *veḷḷam* 'water'; Te. velluva 'flood, inundation' – obviously derived from PDr **vel*. The relationship of the ancient Dravidian concept of sacrifice and that of 'pouring, sprinkling, scattering around' is supported by the parallel etymology of Kui word *lāka* 'sacrifice; to make a sacrifice'. This word – unfortunately unaccounted for in the DED – appears to be cognate to Ta. *aḷakam* 'water'; Ra. *aḷaka* 'a liquid'; Te. *aluku* 'to sprinkle, scatter'; Klm. (SR) *alk* 'to sprinkle'; Nk. *aḷk* 'to sprinkle'; Kui *lanja* 'to sprinkle, scatter around'. If we take into account an ordinary for the Dravidian semantic 'the act, process' $<$ 'the instrument of the process' (Ta. *nāṭṭam* 'examination sight' $>$ 'eye'; nōkku 'sight, vision' $<$ 'eye'; ? Pj. *cōrp* – 'to strain off water from boiled rice' $>$ *cora* 'an earthen pot') the choice of the sign U to express the notion of sacrifice becomes natural and comprehensible.[10]

2.1. The blocks on the obverse of the plates end in the sign -ʒ or the combination ʒUʒ.

"Predvaritel'noe soobščenie" (p. 50) points out that the sign -ʒ belongs to the class of variables and corresponds to one of the case affixes (presumably the Dative affix). This supposition is supported by the comparison of the structure of these inscriptions with the 'sacral formulas' attested in the earliest monuments of the South Dravidian literature and epigraphics as well as in the folklore of illiterate Dravidian tribes. In most Dravidian languages the verbs

[10] On the possibility of the non-Aryan (Dravidian) influence on the form and composition of the Indian sacrificial ritual cf. Chatterjee, 1959, 319–321.

meaning 'to give', 'to present', 'to offer' appear in a tri-partite configuration N_1+N_2+V, where N_1 denotes the direct object and N_2 stands for the indirect object (addressee) of action expressed by the dative. Cf. for instance: Ta. (I–II century A. D.) *amalai-k-koluñ-cōṟṉ ārnta pāṇarkku akalā-c-celvam muḻuvatum ceytēṉ* (PN, 34) '(He) gave all the kinds of wealth to the minstrels who had partaken of the pure white rice'; Ta. (IX) *śrī kṛṣṇarkkum śrī rukmini -p-pirāṭṭi yarkkum ammaṉaṟ kuṭutt-apaṭi eḻutiyatu* "(This) was engraved as the gift by ... to the glorious (god) Kṛṣṇa and glorious goddess Rukmini" (SJJ III-132); Te. (VII century A. D.) ... *pāraku Kuṇḍikāḷḷula iccina pannasa* 'The land free from tax, given to the brahman ... *by the (? chieftain) Kuṇḍikaḷḷu*' (EJ XXVII –288); Te. (IX century) *paṇḍarañgu ... āditya baṭāraniki iccina bhūmi* ... 'The land given to the (god) Adiyta by the (chieftain) *Paṇḍarañga*' (EJ XIX, 271–275); Ko. *amd tongu.l ... čθ. ymk u.tm calcgra.rm* "Our Todas ... pay the meals to god"(K. II 334–337); *Kur.naigas urmī nāḍ guṭṭhige khēr asānum aṛbdas* "The priest makes ... the sacrifice of the fowl to every one of the evil spirits" (Grignard).

3.0 Many radical signs composing the basic block of the averse are identified as the names of deities (owing to their similarity with the Proto-Indian images and pictures. The signs , , , etc. are interpreted in this way.[11]

The appearance of the sign ('a porter') with its variants and in the same position can hardly be explained from the extra-linguistic point of view.

All the same its function in the present context becomes more comprehensible if one takes into consideration the homonymy of the two PDr. root morphemes: (1) **kā-c-(?) *ka-p "pole with ropes hung on the end used to carry loads on the shoulder; a yoke; a banghi"* (DED 1193; Ta. *kā, kāvaṭi*; Ma. *kāvu*; Tu. *kāvaḍi*; Te. *kāvaṭi*; Pj. *kācal*; Koṇḍa *kānj-*; Kuwi *kāca*, etc.) and (2) **kā-, kā-c-, *ka-p "to guard, protect; to preserve, shelter"*. (DED 1192: Ta. *kā, kāppu, kāval*; Ma. *kāvu*; Ko. *ka.v*; To. *ko.* f; Ka. *kā, kāpu*; Te. *kācu, kāyu*; Klm. *kāy-*; Kui *kāpa*; Kur. *khāpus*; Br. *kḫwāfing)*.

If this correspondence proves to be cogent we can regard the sign in the "sacrificial inscriptions" as – for instance- the PDr. archetype of Tamil *kāvaṭ-kaṭavul* "Vishnu" (lit. "god-protector").[12] It seems probable then to explain the contents of the large group of inscriptions with the sign as:

[11] The identification of certain symbols from this group is supported by the data from the Dravidian mythology and onomastice, cf. such paraphrases of the god Skanda (Murugan) as Tan. Ayilan (Ayilavaṉ) < ayil 'spear, javelin'; Vōlaṉ < vēl 'trident, spear'; cf. also Villi, Villavan "the god Kama"; "Virābhadra" < vil 'arrow'.

[12] In the Tamil Brahmi inscriptions the name Kāvuṭi Īteṉ is attested which K. Zvelebil (1964, 562) explains through kāvaṭi 'pole for carrying burdens' + īcaṉ 'god'. Cf. however, Madahevan, 1968, 27 where kāvuṭi is explained from Skr. gauḍa- 'the country of Gauḍa' (the ancient name of Bengal).

"To X (epithet?) (god-) protector – (number) of offerings".

We can interpret in this way such inscriptions as: (H. 475) (H. 607) (H. 680) (MI 532) etc.

The investigation of some Proto-Indian objects (not belonging to the group of "sacrificial inscriptions") allows us to confirm the interpretation given above. The sign is engraved on the obverse of the clay amulet from Mohenjo-Daro (MII, CIII. 1), on the reverse of which we find imprinted figures of two animals – the tiger and the rhinoceros (most probably the brief variant of the politerion "elephant-tiger-rhinoceros-buffalo" – cf. "Predvaritel'noe soobščenie" 1965, 57). As it was stated by the authors of the "Predvaritel'noe soobščenie" 1965, 61–62), the Proto-Indian politerion should be compared with so-called *lokapālavāhanas* – birds and animals representing in the different systems of Indian mythology the regents of the eight points of the compass. The coincidence of occurrance of the sign in combination with such animals is striking and probably significant. It is possible to compare this sign on the amulet with O. Ta. *kāppu* "guardian deities of the eight points of the compass" (Cilap. 28, 231). We should add we do not attempt to reconstruct the "real" morphological appearance of the Proto-Dravidian (or "Harappan") word. We only try to point out that, in our opinion, the sign corresponded in the "Harappan" language to some word derived from the root **kā-* with the same meaning as the Old Tamil *kāppu*. (The occurrence of the supergraph [< +] indicates rather to the derivational morpheme **-t-*; **kā-t-*, e.g., Ta. *kāttayaṉ, kāttavarāyaṉ* "a village deity").

3.1. In other cases the function of the sign may be interpreted differently. In those inscriptions where the symbols identified as the names of deities precede the sign , the text of the obverse may be interpreted by analogy with a "protective formula" so often attested in Medieval Indian epigraphies which concluded donative inscriptions. E.g., O. Ta. (IX c.) *itu ūrārum, kaṉattārum kāval* "The inhabitants of (this) village and (its) officials will protect this" (lit. "the protection (of) this") (SII, XIV-34) . . . *murriyārum itu kāppār* ". . . The authorities will protect this" (SII III-92). The sign in such inscriptions has probably the meaning "protection, preservation" (PDr. **kā)* and the whole text could be interpreted as "X (name or epithet) god (goddess) will protect (this)". Such interpretation may be applied to the inscriptions like (L) or (Ch. III, 28): cf. also H. 404, MI 577 etc.

3.2. Combinations of the symbol with numerals may be interpreted in terms of the Tamil *kā* 'a weight; a burden' (in the later system = 100 *palāms* ≈ 54 kg).

3.3. A further examination of the "sacrificial inscription" leads to the interpretation of certain symbols appearing on the obverse of the plates in preposition to the 'names of deities'.

3.4. The sign and its variants (,) may be determined pictographically as the image of barbel, a fresh-water variety of the carp (Cyprinidae. Barbus – several species are known in north-western India – Barbus tor, Barbus macrocephlus etc.). In the DED, the Dravidian names of the carp are represented by two sets of etyma: (a) 1050 Ta. *kayal, cēl*; Ma. *kayal*; Klm. *kaye* 'fish'; Nk. *kayye*; Pj. *key*; Go. *kīl* (to this group should be added Kui *klīṅgesi* 'fish-bone',[13] (b) 1620 Ta. *keṇṭai*; Ma. *keṇṭa*; Ka. *geṇḍe- mīn* 'a kind of fish'; Te. *gaṇḍe, geṇḍe, geṇḍiya, geṇḍi*.

The Tamil words *kayal, cēl, keṇṭai* are the names of separate species of the carp (Barbus carnaticus, Barbus fimbriatus, etc.). At the same time they may be used both to term the entire Cyprinidae family and any freshwater fishes in general. A similar broadening of meaning apparently took place in other Dravidian languages ("any variety of carp (Barbus)" ">" "a carp" > "a freshwater fish" > "fish").

The Tamil kayal and its correlates go back to the Proto-Dravidian archetype **kay=al* (**key=al*), **kay=* (**key=*)[14] where **=al* is a derivative formant widely occurring in the Dravidian languages. A comparative antiquity of the type **kay=* (**key=*) is borne out from the forms of Parji and Kolami, as well as from the Sanskrit borrowing *kaivartta=* "fisherman". The second name of the Cyprinidae (DED 1620) may be split into two components etymologically which is borne out by the parallel Telugu forms *gaṇḍe, geṇḍe* and *gaṇḍu-cēpa* (*cēpa* 'fish'). Tam. *keṇṭai*, Kan. *gaṇḍe* etc. may be supposed to go back to the PSDr. *kaṇṭay* which in its turn reflects the **kaṇṭu-kay, *kaṇṭu-key*, i.e., the second name derives from the first one,[15] (the possibility of the Proto-Dravidian **=k=* being dropped is proved by the following examples: Ta. *pātu* "portion, share" – e.g., Ta. *paka* "to be split, divided"; Te. *pagulu* "to break, go to pieces", Kuwi *pakhali* "to gash", Kuwi *bhoiyi, bōi* "smoke" – e.g., Ta. *pukai*, Te. *poga* "smoke, fume"; To. *aḍ-* "to dig" – e.g., Ta. *akaḻ* "to dig"; Ka. *agaḻ* "to dig"; Klm. *agul* "to dig" etc.).

For the first etymon not only direct etymology but a distant one could be established. The archetype **kay=, *key=* apparently goes back to the NAME OF THE RED COLOUR, common in all Dravidian languages (DED 1607), whose protoform is reconstructed as **kĕy=, *kĕ=m=, *kĕ=* (cf. Emeneau 1953,

[13] The second component of the Kui word is evidently connected with Kur. khocol, Mlt. qoclu 'bone' (DED, 1816).

[14] On a possible alternation of P–Dr. *-ay//*-ey- cf. Krishnamurti, 1961, 139–140.

[15] The etymology of *kaṇṭu- is not quite clear; perhaps it is connected with P–Dr. *kaṇ-ṭV- (DED, 986) 'male'.

109—110). Such an etymology (connected with the fact that the males of the carp become brightly coloured during spawning) is supported by Skr. *rohit=*, *rohita=* "red colour"; carp (Cyprinus Rohita); cf. also Bengal *rūi-mach* 'carp'. The order and character of phonetic changes in the names of the carp fishes show that the word 'carp' could derive from the word 'red' only in the Proto-Dravidian period.

Our etymology may not only help to establish the origin of certain Dravidian words (e.g., Tel. *cē̆pa* 'fish' < **cē̆mpa* <**kē̆=m=pa*, (?) **key=m=pa)*, but also to explain the frequent occurrence of the sign in the Proto-Indian texts.

The epithet "red" (as well as names and designations derived from this epithet) are frequently attested in the Dravidian mythology, cosmogony and onomastics. Therefore the use of the symbol as the main unit (with a zero formant or with the variable) may be accounted for by a comparison with Tam. *cēy* "planet Mars; the god Skanda" (literally 'red', *Paripatal*, pp. 6–69) or *Kō=c= Cōramān Yaṉaikhaṉ=Cēy* 'elephant-eyed Red /Skanda/, ruler from the /clan of/ Cēra' (the name of a king from the Cēra dynasty – PN, 17, 22, 53). The inscriptions (MII 153) ; (MII 26, MII 47, MII 161) etc. may be interpreted in this way. This could be the meaning of the sign in the inscription (H. 479). The trigramma (MII, C, 64) is interpreted by analogy with Tam. *ceyyavaṉ*, *ceyyōṉ* 'planet Mars, Skanda' *(Tol. Porul.* P 50).

In the sacrificial inscriptions the sign is most often met preceding the sign ('goddess') (Predvaritel "noe soobščenie", 1965, 50—51). The digramma may be accounted for by Tam. *ceyyavaḷ*, *ceyyāḷ* 'the Goddess Lakshmi' *(Paripātal*, pp. 22–4; *Kural*, p. 167); *ceymakaḷ* 'Lakshmi' *(Kallāṭaṉam*, pp. 39–4). Kota *kempy* 'red (the name of a woman)'. Cf. also Tel. *eṟṟama* (< *eṟṟa*) 'red' + *amma* 'Mother, woman' (proper name, VII–VIII century inscriptions) eṟṟapōtamma 'the name of a "rural goddess"' etc. The combination is attested in the inscriptions H. 84, H. 479, MI 137, MII 526.

3.4. The use of the sign in the position under examination is related to the already mentioned homonymy of the Proto-Dravidian roots **mīṉ=* 'fish' and *mĭṉ=/ /*mĭṉ* 'to shine, flash, glitter'.[16] When combined with the supposed *names of the deities this symbol expresses the epithet 'bright, shining, fiery' so common in the Indian mythology and applied to different personages; it may also express the meaning of 'celestial' if the possibility of the **m=/ /*v=* alternation is taken into account and thus the etymological relationship between **mĭṇ=* 'to shine' and **viṇ=/ /*miṇ=* 'sky' (DED 4422) is acknowledged (about a possibility of this relationship cf. Ramaswami Aiyar). E.g., Ta. *viṇ-kō* "Indra"

[16] The Sanskrit root miñj- "scheinen, leuchten". (Bötlingk, 1884, 77) is an evident borrowing from the Dravidian languages. The second meaning of this root "reden, sprechen" is related to the Proto-South Dr. *miṇ- 'to mumble, prattle' (DED, 1978).

(lit. "the lord of the heaven"; *viṇṇavaṉ* "celestial being"; Te. *vinudrammari* "god" (lit. 'one who shakes the sky'; *minusigavēlupu, vinusigadēvara* "Śiva" literally, "the god having the sky as the lock of hair on the crown of the head".

Thus, the combination attested in several inscriptions (MI 24, MI 214, H. 342 etc.) may be defined as the prototype of the designation of the Goddess Saraswati *minukūjēdiya* preserved in the Telugu mythology *(minuku* 'flash, twinkle, glitter' + *cēḍiya, cēḍe* 'woman').[17] The broadening of meaning of the sign with regard to the Proto-Dravidian etymon **viṇ/ /*min-* 'sky' provides new interpretations of various polygrams including this sign. A further examination of the Proto-Indian texts should ascertain whether such Dravidian parallels as Mlt. *biṉye* 'the god of thunder and lightning' have, perhaps, to be considered in the interpretation of the sign within the basic block (e.g., in the digraph).[18] Attention should also be paid to the fact that the sign and the trigram are attested in two inscriptions (MII 222, MII 420) accompanying the picture of a three-faced enthroned personage.

3.5. Polygrams in which the sign precedes the sign should be discussed separately. The sign has been interpreted as a stylised image of the bird (presumably, eagle, black kite or hawk) on the basis of a picture on the seal-amulet H. 255 in which M. Vats (H. p. 356) and other scholars found some similarity with pictures of Garuda. A considerable part of Garuda's names is etymologically related to the words 'light', 'shine', 'fire', 'sun': *mahātejaḥ* 'endowed with great shine' (Mbh., I, 20; 4); *agni rāśir ivodbhā sansamiddhaḥ* 'shining as a column of fire' (Mbh., I, 20; 7) etc. If visual similarity alone is not sufficient enough to identify the sign with the picture of the sacred bird (the symbol is highly conventionalised and can, therefore, be interpreted in a variety of ways) the block with this sign fully supports such an interpretation: in many inscriptions this symbol is preceded by the doubled sign , i.e., the one which might presumably have Proto-Dravidian *mīṇ*= as its phonetic value (cf. Ta. *miṉmiṉi* "firefly", Te. *minuku-minukum-anu* 'to twinkle' etc.).

The indirect evidence suggests the possibility of a Dravidian origin of the Garuda cult in the Indian mythology. To begin with, the word *garuḍa* = itself cannot be satisfactorily etymologised on the Indo-European background;

[17] The Indian epic supports indirectly the presence of the epithet *min- 'bright' in the pre-Aryan mythological inventory. The story of Skanda's origin includes "a paired deity" Miñjikā (fem.) and Miñjika (masc.) which emerged from Rudra's semen, see Mbh. III, 231; 10, 14. The commentators trace this name back to the root miñj- 'to shine' (Smirnov, 1958, 664; cf. Hopkins, 1915, 231). On the possible alternation of PDr *-ṇ- // *-*n* — cf. Krishnamurti, 1961, 87.

[18] Many scholars beginning with R. Caldwell tried to establish etymological links between the name of the sun god Visnu and the Proto—Dr. *vin-//*min 'sky' (cf. Ramaswami Aiyar, 1944, 149—150; Chatterjee 1959, 323). This etymology cannot be regarded as reliable.

traditional etymologies cited by Nashburn Hopkins (1915, 21—22) may safely be disregarded. S. K. Chatterjee (1954, 19) finds it possible to relate this word to PDr. *$kaḻ=V$* 'hawk, black kite, eagle' (cf. DED 1147: Tam. *kaḻu(ku)*; Mal. *kaḻ u(ku)*; Toda *koṟṭ*, Tulu *karu*). Whereas in Old Indian monuments the mythical bird Garuda had no concrete prototype among the birds (a partial identification of Garuda with the peacock — Hopkins, 1915, 21 — does not agree with its descriptions in myths), the Dravidian linguistic usage clearly had this prototype, cf. Tam. *karu-ṭaṉ* 'Garuda, white kite'. The name *Kaḻu*, *Kaḻuvuḷ* 'eagle' is attested in the Tamil Sangam literature as well as in the Brahmi inscriptions. The hawk, eagle and kite are traditional personages in the folklore and mythology of such illiterate Dravidian peoples as Kota, Gond or Kurukh.[19]

3.6. The most frequent epithet of the sign ('goddess') is the sign presumably interpreted as 'great' ("Predvaritel 'noe soobščenie" 1965, 51). The stable functions of the sign and its limited occurrence (apart from the sign it is followed almost exclusively by the sign) did not allow it to be related to a concrete Dravidian prototype. The inscription H. 106 is of special interest since the function and environment of the sign are quite unique here:

The sign following the sign belongs to the class of variables and often appears at the end of the initial block. Therefore the combination should in this case be regarded as an independent block 'determined' by the numeral 24. The structure of inscription H. 106 leads to the conclusion that the combination is an analogue of Sanskrit *caturviṁśa(ka)*, a designation of the year as consisting of 24 halves of the lunar month – Sanskrit. *pakṣa* which was common in the Post-Vedic religions and mythological literature (*Ait. Br.*, 3, 5, 96). This term for "year" may appear not only in purely chronological inscriptions. Some scholars of the Old Indian epic mythology note the personification of the year as a cosmic deity. (cf. Hopkins, 1915, 68—70).

Sanskrit term *pakṣa* corresponds to Tamil *piṟai* "crescent moon" which has also the meaning "a fortnight, a half of lunar month". (E.g., Ta. *valarpiṟai* "the bright half of lunar month" literally "waxing moon" and *tēypiṟai* "the dark half of the month", "waning moon"; cf. also To. *peṟ* "days from the third to the eighth after new moon"). The Tamil *piṟai* is derived from the

19 In the Kota folk-tales the bird gira. ·lm is mentioned which resembles the hawk but is many times bigger (Emeneau, 1944, 165). The hawk and the kite are among clan totems of the Kurukh (Hahn, 1900, 93). About the function of the hawk in the totemic religion of the Gonds cf. Ferreira, 1865, 137—38, 144.

PDr. **peṭ* "to bear, produce" (DED 3622). Meanwhile the PDr. etymon **peṭ-* has as homonym the other PDr. root **peṭ-* "to grow full, to be great, greatness" (DED 3624: Ta. *peṟṟam* "greatness", *piṟaṅku* "to be great, exalted" etc.).

Leaving aside the problem of the reality of etymological relations between PDr. **peṭ=* 'to be great' and **pĕr=* 'great' (DED 3613), it should be pointed out that the use of the sign "ᛘ" in inscription H. 106 not only does not contradict the interpretation of this symbol as the epithet 'great' based on cultural-historical considerations but, on the contrary, provides an opportunity for determining its tentative phonetic value (=PDr. **peṭ=*).

3.7. Coming to the end of our study of "sacrificial inscriptions" let us examine the inscription ᛟᚷ ꝉ ||U (H. 342) which is included into this corpus. The third sign of the inscription ꝉ is, in all probability, a picture of a fishing hook (it resembles very closely the photographs and drawings of the fishing hook found in the Indus valley towns which were published in archeological records – Rao, 1957, fig. 16). The appearance of this sign in the inscriptions presumably connected with offerings to deities may be explained only if the following Proto-Dravidian homonymy is taken into account: **kuṭ=/ /*koṭ=* 'crooked, curved' (DED 1709) – the names of hooks, sickles, garden scissors etc., in the Dravidian languages are usually derived from this root – and **koṭ=/ /*kuṭ=* 'to give, bestow, present'. The verbs 'give' and 'present' derived from the root **koṭ=* in the Dravidian languages are used mostly in the meaning 'to give something to somebody who, as a rule, is senior in age or position'. In this case, however, it is possible not only to identify the sign ꝉ with a definite phonetic complex, but to establish both the morphological structure of the Dravidian correlate and the character of the inscription. The name of the instrument from the root **kuṭ=/ /*koṭ=* is often formed in various Dravidian languages by means of the derivational morpheme beginning with a labial consonant *=p=*, *=v=*, cf. Toda *kwïṛ fo.l* 'hook, billhook'; Tel. *koḍavali* 'sickle'; Klm. *koḍval* (pl. *koḍvasil)* 'sickle', Nk. *koḍval* 'sickle' etc. (e.g., Kui *gōṭoṛi*, *gōṭoni* 'hooked, bent like a hook'). At the same time a morpheme beginning with a labial consonant is one of the oldest Tamil causative formants, cf. in the Brahmi inscriptions[36] *koṭu= pi=t=ōṉ* 'he that made give'. If a case of abbreviated writing is assumed to occur once again and the sign ꝉ is taken to render the causative stem morpheme, the correlation between the name of the deity and the verb "to make (somebody) give (to the one who makes)," appears consistent with the rules of the Old Tamil grammar and norms operating in other Dravidian languages. As "peripheral" morphemes are not written alongside with the symbol a double interpretation is feasible: (1) the sign ꝉ represents the name of action. In this case the combination on the averse of the plate renders the subject, while that on the reverse renders the predicate; (2) the sign ꝉ renders "the verbal attribute" (participle). In

this case part of the text on the obverse is the attribute of the digraph on the reverse.

Thus, it becomes possible to interpret inscription H. 342 in the following way:

Text: [1] [2] [3] ıı [4] ∪ [5].

Tentative transliteration (capital letters denote alternating phonemes whose exact value cannot yet be identified: *= =ṇ=/ /=ṉ=; *=p=/ /*=v=; *=u=/ /*=o=; the symbol = is written in those cases when the dropping of the accessory morphemes is possible; /V/ denotes an unknown vowel):

(1) *miṇ=* (2) /goddess/ (3) *kŭṭ*/V/P= (4) II (5) *vēḷ*/V/P=.

Translation "That which the shining (var. celestial, beautiful) (1) goddess (2) made us give (var. makes us give) [her] (3) [is equal] to two (4) offerings (5)", or: "Two of offerings (5), which the shining (celestial, beautiful) (1) goddess (2) made us give her (3)".[20]

COMMENTARY

With Gurov's paper, which is, in some respects the most engaging of the lot, but at the same time the most conjectural, the reader is immersed in the stream of concrete Dravidian data. However, as soon as one attempts to fill the 'empty slots' of stable, semi-variable and variable signs with concrete Dravidian phonic material – roots and suffixes – one necessarily enters onto the slippery ground of speculation. One must emphasize that the 'readings' arrived at by such procedures cannot be either proved or disproved. At least not on the strength of the evidence offered by Knorozov and his team.

I. GENERAL (INTRODUCTORY)

Granted that we accept (a) that the script IS INDEED LOGOSYLLABIC (which it very probably is), and, (b) that there is a SIMPLE TRANSFER between the signs of THE SCRIPT and the grammatical categories of THE LANGUAGE, which means, that (c) the semi-variable and variable signs really represent derivational and inflectional morphemes, while the constant signs represent roots (to accept this requires an 'act of faith' of a sort on our part), and, (d) that the TYPOLOGICLA features of the 'Proto-Indian language' point to Dravidian and DRAVIDIAN only (which may require an even stronger 'act of faith' on our part), THEN and

[20] Abbreviations for the names of languages, mentioned in this article; Br. — Brahui; Ga. (S) — Gadaba (Salur); Go. — Gondi; Ka. — Kannada; Klm. — Kolami; Ko. — Kota; Koḍ. — Koḍagu; Kur — Kuruḵh; Ma. — Malayalam; Mlt — Malto; Nk — Naiki; O — old; PDr. — Proto-Dravidian; Pj — Parji; PsDr — Proto—South—Dravidian; Skr — Sanskrit; Ta. — Tamil; Te. — Telugu; To. — Toda; Tu. — Tulu.

ONLY THEN can we go along with Gurov in his further attempts to 'read' the signs. While it is probably easy to accept point (a), it is more difficult to accept points (b–d). As we pointed out in the commentary on Kondratov's paper, none of the authors have made it sufficiently clear anywhere that they were aware of the distinction "script language". We have also stressed earlier that the variables and semi-variables might have been employed to express something other than grammatical features. To this one should probably make further comments with regard to the graphic additions which are treated as "ornamental allography" or "ornamental elements" – in any case, as non-meaningful "empty" allographs. Is this really so? Do not these minute additions have some FUNCTION – grammatical, phonic, (segmental and/or suprasegmental)? As far as point (d) is concerned, it seems to us that the typological equation with Dravidian is plausible, even probable, but certainly not the only one POSSIBLE. Gurov, on pp. 120–03, paragraph o. 3 describes, and very successfully and quite precisely, some basic features of Dravidian morphology, morphophonemics and syntax. Once we accept the typological equation of the Harappan language with a Dravidian-like language, we can indeed enter the field of the actual "decipherment", i.e., reading and translation of the Harappan inscriptions, and let ourselves be introduced by Gurov to the meanings of some of the words, word-combinations and utterances. However, the problem is that this typological equation has also to be accepted as an "act of faith", since the basic properties of the "Proto-Indian language", enumerated several times by the authors – i.e., stable roots followed by derivational and inflectional suffixes, no prefixes or infixes, a word order mostly of the type S (0) P, and determining member preceding the determined – these features apply equally well to some other languages and language families, i.e., Altaic.

2. DISCUSSION OF INDIVIDUAL POINTS

1. The whole "decipherment" rests on a few slender premises, and a few equations between the shapes of various signs and the corresponding Common Dravidian phonemic shapes of words denoting objects which are supposed to underly the derivation of the signs, and on a few cases of striking homophony in Dravidian. However, the absence of concrete tables of signs and grids both for identifying the functional (paradigmatic and syntagmatic) properties of the signs themselves in order to establish some idea of the consistent internal system of the writing, and for correlating various paradigmatic series of signs or auxiliary marks on grids in order to identify the GRAMMATICAL SYSTEM is a serious oversight which greatly undermines the value of these analyses and completely jeopardizes the validity of their conclusions.

(a) It is true that the Harappa civilization chronologically coincides with the period of a (highly hypothetical and as yet un-reconstructed) "single" (even

this must be taken *cum grano salis*!) Proto-Dravidian language, p. 119 of Gurov's article. Gurov does not say this anywhere explicitly, but we should say it here, and it will be a point in his favour that Dravidology as a serious linguistic discipline has advanced far enough to be able to attempt a reconstruction of Proto-Dravidian with a fair amount of certainty, and that the situation in Dravidian is such that we CAN take such reconstruction as a basis for the comparison with "Proto-Indian, deciphered" forms – rather than with some individual Dravidian language such as Proto-Tamil or Proto-Brahui. What Gurov says, and what is quite correct (p. 119) is that the genetic divergence in Dravidian has not progressed as far as among some other language families; the rate of change has been comparatively slow.

(b) Some of the premises are, however, very tenuous: e.g., the presupposition that the texts are of "very specialised contents" (p. 119) or that the inscriptions Gurov deals with are "sacrificial" (p. 125).

(c) On p. 120 Gurov recommends, as possible Dravidian sources, the Brāhmī Tamil inscriptions of the first centuries B. C. and A. D., as well as the Tamil, Telugu, Kannada and Malayalam inscriptions of the sixth to tenth centuries A. D. (among other sources). There is no doubt that these sources will have to be taken into account, but it is another matter whether the conclusions based on them can be accepted at all for the immediate purpose of comparing these data with the Harappan material. The Brāhmī epigraphs are extremely short, limited and repetitive in content, owing their origin probably to bilingual Jaina and/or Buddhist monks whose mother-tongue probably was not even Tamil. They contain very little data of value for our purposes, being restricted mainly to a few personal and/or local names, and to extremely brief statements about caves and beds cut in rocks. The later inscriptions in the great Southern literary languages are, first, separated by a tremendous gap of time from the Proto-Indian texts and, second, they are overlaid by a strong stratum of Indo-Aryan and "Sanskritic" element – culturally, linguistically etc.

2. Gurov starts with his actual decipherment on p. 122 with a very weak premise saying that blocks delimited by the signs –Ʊ 人 "are in fact names of different persons and mythological figures . . .", SINCE they form, as SINGLE blocks, WHOLE inscriptions. It is plausible, but entirely speculative. In fact, blocks ending in the final digram –Ʊ 人, which, according to Gurov and Katerina's "Review"[1] is the sequence "morph of the oblique + gender suffix", could be equally easily interpreted "professions" + "obl. (?)" "gender suffix" (cf. Ta. Ma. *kol-l-aṉ* 'blacksmith' *Puṟam*, 21.7., 36.6 etc., first century B. C. – third century + A. D., or Ta. Ma. *vēṭ-aṉ* 'hunter' Ta. *vēṭṭuvaṉ* 'hunter', *Puṟam* 19.5; 33.1 etc.), or tribal/ caste names (e.g., Ta. *vēṭ-a-cci*, *vēṭ-i-cci* 'woman of the hunter tribe' or Ta. *maṟ-a-v-an* "inhabitant of the desert, member of the M. tribe, etc.'),[2] or, and this is probably even more significant and interesting,

such forms could also be 'read' as finite verb forms, or participial nouns, since in Dravidian, the endings of finite verbs are pronominal in nature and origin; thus e.g., a sequence ending in the digram – + could easily be read e.g., as *-t-ān/-ōn*, i.e., a past tense morph **-t-* (homophonous with the "oblique case morph" – – = **-t-)* and the 3rd person singular masculine suffix (a person-gender-number suffix of the finite verb, which is attested since the earliest strata of Tamil, cf. forms like *koṭu-tt-ōṉ* 'he gave, he who gave'; PN 338.7, *cey-t-ōṉ* 'he made' PN 341.5, 371.24. This "leaving open" of the phonemic-morphemic value of is of course necessary for Gurov since otherwise, how would he account for the sequences (H. 164 etc.) which he equates with OTa. *mummīṉ* ('three stars' plus "oblique" + "gender"?). The same concerns the tetragram which is interpreted as 'six' (PDr. **cāṟu/*caṟu-)* 'stars (fish)' – "oblique" – "gender suffix", and compared with one of the epithets of Murugan. The phonic value **-t-* is certainly not feasible for these phrases.

3. Gurov then proceeds to assign meanings to a few signs, working usually with Dravidian HOMOPHONY; two or three cases are – as usual – highly speculative, but the speculation is very ingenious and leads to quite plausible results, e.g., the homonymy of DED 1193 and DED 1192, the first having the underlying meaning 'to bear a burden', the second 'to guard, protect'. On the other hand, some etymological connections are very hard to accept, e.g., Gurov connects DED 4561 *vēḷ* 'to offer sacrifice etc.' with DED 4526 *veḷi* 'outside, exterior' (and probably with even DED 4459 since he etymologises **veḷ-/*viḷ-)*, and with 4529 *veḷḷam* 'water, flood'. This etymological connection is based on a partial and rather distant semantic resemblance and therefore it should not be called "obvious" (p. 125 of Gurov's article). Probably hardest to accept is the equation of the sign – with the dative which is carried over from the preliminary report of 1965. (See Part One). How to account for the "reduplication" of this very frequent sign, if it is a dative suffix (reconstructed by Dravidianists as **-k/u)*?

4. Pages 126–30 seem to contain the most successful identifications (and the most ingenious speculations) – always granting the preliminary acceptance of the several "acts of faith" mentioned above. There is nothing wrong with these equations from the Dravidianist's point of view. However, one minor point is the derivation of PSDr. **kaṇṭay* 'a kind of fish" (DED 1620) from **kaṇṭu-kay* which is utterly speculative, and contains two mistakes: (a) the form *gaṇḍe* is not Ka. but Te., where it is in alternation with *geṇḍe*; (b) the PSDr. and PDr.

2 See the Bibliography of Part Two, Gurov and Katerina, 1967.

1 Cf. A. Parpola *et al.*, pp. 29–30. The equation of with an oblique (genitive?) case suffix is not improbable, but, as Gurov rightly says, the phonemic and morphemic values of this sign should definitely be left open – for the time being.

reconstruction should be rather **keṇ-ṭ-(ay)* and not **kaṇṭay* (cf. the Kur. *kiṇḍō* DED 1620). But this is only a minor point. The etymological connection between DED 1607 and 1050 is very attractive. It is also true that the epithet 'red' is very frequent in Dravidian mythology. Red and black are somehow involved in the structure of "matters Dravidian' in the spheres of psychology, language, mythology, symbolism etc.

5. Another excellent observation of Gurov's is his interpretation of the geminated fish-sign as 'celestial, shining, beautiful', and his "reading" of this sequence in true Dravidian fashion as **mīṇmīṇ-*. In support of Gurov, cf. Tu. *miṇimiṇi* 'glistening' etc., under DED 3994. On the other hand, the two signs, the "reduplication", might have expressed plurality.[3] In that case, the double fish sign would probably signify 'sky' ('many stars'), if we want to accept the etymological connection between this cluster of etyma and DED 4422 Ta. *viṇ*. It is not improbable.

6. What is more difficult to accept is the 'reading' of the sign "ᛉ" as 'great' – again a carry over from the 1965 report. This "reading" is based on the frequent occurrence of the sign ᛉ "read" as goddess (which is itself not so certain), and on the fact that its occurrence is limited only to the conjunction with this and the 'fish'-sign. It is equally difficult to accept the etymological connection between DED 3613 and DED 3624. It must be pointed out that whenever a connection such as this one is suggested for PDr. it involves a fully functional and very productive basic phonemic contrast between an alveolar stop **t* (written as *r* for Tamil), and an alveolar flap **r*.

7. The homonymy suggested by Gurov on p. 132, namely DED 1709 **koṭ-/ *kuṭ-* 'curved, crooked' and DED 1708 *koṭ-/ *kuṭ-* 'to give' is perfectly in order, and the reading of the "hook-sign" in the meaning of 'give' is therefore very attractive.

8. At the end of his paper Gurov gives a tentative transliteration and TRANSLATION of one short inscription H. 342. It is certainly not one of the most difficult inscriptions. The latter portion, consisting of a numeral (II, two) and the "cup" sign (U), may be easily read as 'two cups' or 'two offerings'. The first portion of the inscription containing the fish-sign and the "great goddess" sign is not so convincing. The third sign, the 'hook' sign, is "read" as 'made us give' or 'makes us give' positing a causative morpheme after the stem (which is highly speculative; the sign might just as well be read **koṭ-V-p/u* 'giving gift').

[3] Cf. A. Parpola *et al.*, *Decipherment*. p. 23.

3. CONCLUSION

1. First, the SPECULATIVE nature of the attempt at decipherment should probably not only have been ADMITTED, but STRESSED by Knorozov and Gurov. As had been pointed out, it is necessary to accept a series of 'acts of faith' to even follow Gurov onto the field of concrete readings; and in this field itself, most of the proposed readings are purely speculative. This should have been said, and the extremely TENTATIVE nature of the results should have been at least indicated. On the other hand, with the absence of bilingual material, and with the inscriptions limited in size as well as probably in contents, there is hardly any other procedure possible than the one employed by the Knorozov team: positional statistics based on frequency counts, and subsequently, an INTUITIVE-SPECULATIVE approach.

2. Gurov's intuitions are based for the most part on SOLID LINGUISTIC KNOWLEDGE of the COMPARATIVE DRAVIDIAN MATERIAL. His speculations are, frequently, rather attractive, and very ingenious.

3. The conclusions are POSSIBLE, but ENTIRELY HYPOTHETICAL, and, at the present stage of "decipherment", ABSOLUTELY UNVERIFIABLE.

Proof that the readings and translations are correct may be offered only in the following way: (a) either a BILINGUAL inscription or inscriptions will confirm the correctness of the "Dravidian hypothesis"; (b) or, in the absence of a bilingual text, a much greater amount of material must be read, translated and interpreted, and this large sum of TRANSLATED DATA must form a MEANINGFUL, LOGICAL AND INTERNALLY CONSISTENT CORPUS OF DATA. Until then, the Dravidian affinity of the Proto-Indian language remains only a very attractive and quite plausible HYPOTHESIS.

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BIBLIOGRAPHY

Bloch, J. *The Grammatical Structure of the Dravidian Languages* (authorized translation) (Poona, 1954).

Bosch, E. D. K. *The Golden Germ. An Introduction to Indian Symbolism* (Mouton, 1960).

Böthlingk, O. *Samskrit-Wörterbuch in kurzer Fassung*, V. Teil (St.-Petersburg, 1884).

Burrow, T., Emeneau, M. B. *A Dravidian Etymological Dictionary (DED)* (Oxford, 1961).

Caldwell, R. *A Comparative Grammar of the Dravidian or South-Indian Family of Languages* (London, 1856).

Chatterjee, S. K. *Languages and the Linguistic Problem* (Myzore, 1945).

Chatterjee, S. K. "Old Tamil, Ancient Tamil and Primitive Dravidian", *IL*, vol. XIX (1954).

Chatterjee, S. K. "The Indian Synthesis, and Racial and Cultural Inter-Mixture in India" *T. C.*, vol. VIII, N 4 (1959).

Emeneau, M. B. "A Dravidian Etymology of the Sanscrit Proper Name Nata", *Publications in Classical Philology*, vol. XII.

Emaneau M. B. *Kote Texts*, pt. I (Berkeley and Los Angeles, 1944).

Emaneau, M. B. "Proto-Dravidian * C.: Toda t-", *BSOAS*, vol. XV, No. 1 (1953).

Cadd, B. S., "Seals of Ancient Indian Style Found at Ur", *Proceedings of the British Academy*, vol. XVIII (1933).

Ferreira, John V., *Totemism in India* (Oxford, 1967).

Gopinatha Rao, T. A. *Elements of Hindu Iconography* (Madras, 1916).

Gordon, D. H. *The Prehistoric Background of Indian Culture* (Bombay, 1958).

Гуров Н. В.,—Т. Е. Катонина, «Новый этап в изучении протоиндийских надписей», *Советская этография*, № 2 (1967).

Hahu, Fr. *Kurukh Grammar* (Calcutta, 1900).

Heras, H. "La oscritura proto-indoca y sa dasciframiento", *Ampurias*, Vol. I. (Barcelona, 1940).

Hunter, G. R. *Script of Harappa and Mohenjo-Daro* (London, 1934).

Keith, A. B. *The Mythology of All Races*, vol. VI. (New York, 1964).

Киорозов Ю. В., см. *Предварительное сообщение об исследовании протонидийских текотов* (Москва, 1965).

Krishnamurti, Bh. "Proto-Dravidian * Z", *IL Turner Jubileo*, vol. I. (1958).

Krishnamurti, Bh. *Telugu Verbat Bases* (Berkeley, 1961).

Kuiper, F. B. J. *Note on Dravidian Morphology (Acta Orientalia)* (Leiden, 1948).

Kuiper, F. B. J. "Rigvedie Loanwords", *Studia Indologica* (Bonn, 1955).

Lahovary, H. *Dravidian Origins and the West* (Bombay—Calcutta—Madras, 1964).

Lel, B. B. "The Direction of Writing in the Harappan Script", *Antiquity*, vol. XL, N. 197 (1966).

Maskay, K. J. H. *Further Excavations of Holenjo-Daro* (Delhi, 1938).
Maskay, K. J. H. *Chanbu-Daro. Excavations 1935—1936* (New Haven, Connecticut, 1943).
«Махабхарата». вип. IV. («Беседа Маркандеи»). Перевод, введение, привмечания и толковый словарь академика АН ТССР Б. Л. Смирнова, Амхабад, 1958.
Mahadevan, G. "Tamil-Brahmi Inscriptions of the Bangum Age", *II. International Conference — Seminar of Tamil Studies* (Madras, 1968).
Marshall, J. *Mohenjo-Daro and the Indus Civilization* (London, 1931).
Meenakshicundaran, T. P. *A History of Tamil Language* (Poona, 1965).
Марнарт А. М., *Грамматика тамильского разговорного языка* (Ленинград, 1929).
Hoor, E. *The Pantheon* (London, 1810).
Предварительное сообщение об иследовании протоиндийских текстов (Москва, 1965).
Пробст М. А., *Предварительное сообщение об исследовании протонидийских тексто* (Москва, 1965).
Quintana Vives, Jorge. *Approtaciones a la interpretacion de la escritura prot india* (Madrid, 1946).
L. V. Remaswaami Aiyar, "Dravidic "fish", "star", sky," *IL*, vol. IX. (1944).
Rao, S. R. "The Excavation at Lothal", *Lalit Kalā*, Nos. 3—4 (April 1956—March 1957).
Vata, M. S. *Excavations at Harappa*, I—II (New Delhi, 1940).
Washburn Hopkins, E. "Epic Mythology", *Grundrise der Indo-Arischen Philologie*, Bd. III. Hft I (Strassburg, 1915).
Wheeler, M. *The Indus Civilization* (Cambridge, 1953).
Wilkins, W. J. *Hindu Mythology* (Calcutta, 1882).
Волчек В. Я., *Предварительное сообщение от иследовании протоиндийских текстов* (Москва, 1965).
Zvelebil, K. "Dative in Early Old Tamil", *IIJ*, vol. IX, N 3 (1958).
Zvelebil, K. "The Brahmi Hybrid Tamil Inscriptions", *AOr*, vol. 32, No. 3 (1964).
Zvelebil, K. "Comparative Study of the Dravidian Family of Languages", *AOr*, vol. 32, No. 3 (1965).
Zvelebil, K. Yu. Glasov, M. Andronov, *Introduction to the Historical Grammar of the Tamil Language* (Moscow, 1967).

REVIEWERS' REFERENCES

Allchin, Bridget and Raymond, *The Birth of Indian Civilization* (Baltimore, 1968).

Andronov, M., "Lexicostatistic Analysis of the Chronology of Disintegration of Proto-Dravidian", *Indo-Iranian Journal*, VII, 2–3 (1964): 170–186.

Bloch, J., *Structure grammaticale des langues dravidiennes* (Paris, 1946).

Bodding, P. O., *Materials For A Santali Grammar*, two parts (Dumaka, 1922–30).

Burrow, T., and M. B. Emeneau, *A Dravidian Etymological Dictionary* (Oxford, 1961). (=DED)

—, *A Dravidian Etymological Dictionary, Supplement* (Oxford, 1968).

Caldwell, R., *A Comparative Grammar of the Dravidian or South-Indian Family of Languages*, 3rd ed. (London, 1913).

Chadwick, John, *The Decipherment of Linear B* (Cambridge, 1958).

Dani, Ahmad Hasan, *Indian Paleography* (Oxford, 1963).

Danielou, Alain, *Hindu Polytheism* (New York, 1964).

Diringer, David, *The Alphabet*, 3rd ed., vols. I, II (London, 1968).

—, *Writing* (London, 1962).

D'jakonov, I. M., *Jazyki Drebnej Perednej Azii* [Languages of ancient Asia Minor] (Moscow, 1967).

Emeneau, M. B., "Linguistic Pre-history of India", *Proceedings of The American Philosophical Society*, vol. CXVIII, 4 (1954).

—, "Sketch of Dravidian Comparative Phonology", mimeographed (Berkeley, 1963).

—, *Brahui and Dravidian Comparative Grammar (=University of California Publications in Linguistics* 27) (1962).

—, "Dravidian and Indo-Aryan: The Indian Linguistic Area", mimeographed (Austin, 1968).

Emeneau, M. B., and T. Burrow, *Dravidian Borrowings from Indo-Aryan* (=University of California Publications in Linguistics 26) (1962).

Friedrich, Johannes, *Geschichte der Schrift* (Heidelberg, 1966).

—, *Entzifferung verschollener Schriften und Sprachen* (Heidelberg, 1966).

Gelb, Ignace J., *Hittite Hieroglyphs (=Studies in Ancient Oriental Civilizations* nos. 2, 14, 21) (Chicago, 1931–42).

Gordon, D.H., *The Prehistoric Background of Indian Culture*, 2nd ed. (Bombay, 1960).

—, *A Study of Writing*, 2nd ed. (Chicago, 1963).

Grierson, G. A., *Linguistic Survey of India*, vol. IV (Calcutta, 1906).

Heras, Rev. H., *Studies in Proto-Indo-Mediterranean Culture*, vol. I (Bombay, 1953).

Hunter, G. R., *The Script of Harappa and Mohenjo-Daro and its Connection with Other Scripts* (London, 1934).

Jensen, Hans, *Geschichte der Schrift* (Hanover, 1925).

—, *Die Schrift in Vergangenheit und Gegenwart*, 2nd ed. (Berlin, 1958).

Krishnamurti, Bh., *Telugu Verbal Bases: A Comparative and Descriptive Study* (Berkeley, 1961).

Lal, B. B., "The Direction of Writing in the Harappa Script", *Antiquity*, Vol. XL (1966) pp. 52–55.

Macdonell, Arthur Antony, *A Practical Sanskrit Dictionary* (Oxford, 1929).

Mackay, E. T., *Further Excavations at Mohenjo-daro* (Delhi, 1930). (=MII)

—, *Chanhu-Daro. Excavations, 1935–36* (New Haven, Connecticut, 1943). (=Ch.)

Marshall, J., *Mohenjo-daro and The Indus Civilization*, 3 volumes (London, 1931). (=MI)

Meillet, A., and Marcel Cohen, *Les langues du monde* (Paris, 1952).

Monier-Williams, M., *A Sanskrit-English Dictionary*, 2nd ed (Oxford, 1899).

Munda, Ram Dayal, *Proto-Kherwarian Phonemic System*, mimeographed (University of Chicago, Chicago, 1968).

Paper, H. H., *The Phonology and Morphology of Royal Achaemenid Elamite* (Ann Arbor, 1955).

Parpola, A., *et al.*, *Decipherment of the Proto-Dravidian Inscriptions of The Indus Civilization* (Copenhagen, 1969).

Parpola, A. and S., *Computing Approach to Proto-Indian*, 1965. *An Interim Report* (with S. Koskenniemi) IBM report.

Pinnow, H. J., "A Comparative Study of the Verb in The Munda Languages", in N. H. Zide, ed., *Studies in Comparative Austroasiatic Linguistocs* (The Hague, 1966).

Ross, Allen S. C., "The Numeral Sings of the Mohenjo-daro Script", *Memoirs of the Archeological Society of India*, No. 52 (Delhi, 1938).

Stampe, David L., "Recent Work in Munda Linguistics", 3 parts *International Journal of American Linguistics*, Vol. 31, No. Vol. 32, Nos. 1, 2 (1965).

Sullivan, Herbert P., "A Re-Examination of the Religion of the Indus Civilization", *History of Religions*, Vol. 4, No. 1 (Summer, 1964).

Tamil Lexicon (Madras, 1924—39).

Thurston, Edgar, *Castes and Tribes of Southern India*, 7 Vols. (Madras, 1909).

Vats, M. S., *Excavations at Harappa*, 3 vols. (Calcutta, 1940).

Zide, Arlene R. K., "Pronominal Incorporation in Parengi", mimeographed (Philadelphia, 1963).

—, "Some Problems in The Generation of Gorum Obstruents and Related Glides", moimeographed (= Papers on South Munda Phonology VII) (Chicago, 1966).

—, "A Brief Survey of Work to Date on the Indus Valley Script", *Papers From The Fourth Regional Meeting of Chicago Linguistic Society* (Chicago, 1968).

-, "*The Indus Valley Script. A Selectively Annotated Bibliography*", unpublished Manuscript (Chicago, 1968).

Zide, N. H., "*Korku Phonology and Morphophonemics*", Ph. D. Dissertation (University of Pennsylvania, Philadelphia, 1960).

—, "Korku Low Tone and the Proto-Kherwarian Vowel System", in Zide, ed., *Studies in Comparative Austroasiatic Linguistics* (The Hague, 1966).

Zvelebil, Kamil, "Dravidian Philology, General Linguistics, and Early History of India", *R. P. Sethu Pillai Commemorative Volume* (Madras, 1961) pp. 127—43.

—, "Harappa and The Dravidians – An Old Mystery in a New Light", *New Orient Bimonthly* 4. 3 (1965): 65–69.

—, "An Introduction to The Comparative Study of Dravidian", *Archiv Orientální* 33. 4 (1965): 367–396.

—, *Comparative Dravidian Phonology* (Mouton, The Hague, Paris, 1969).